INSTRUCTION MANUAL

Serial Number ____________

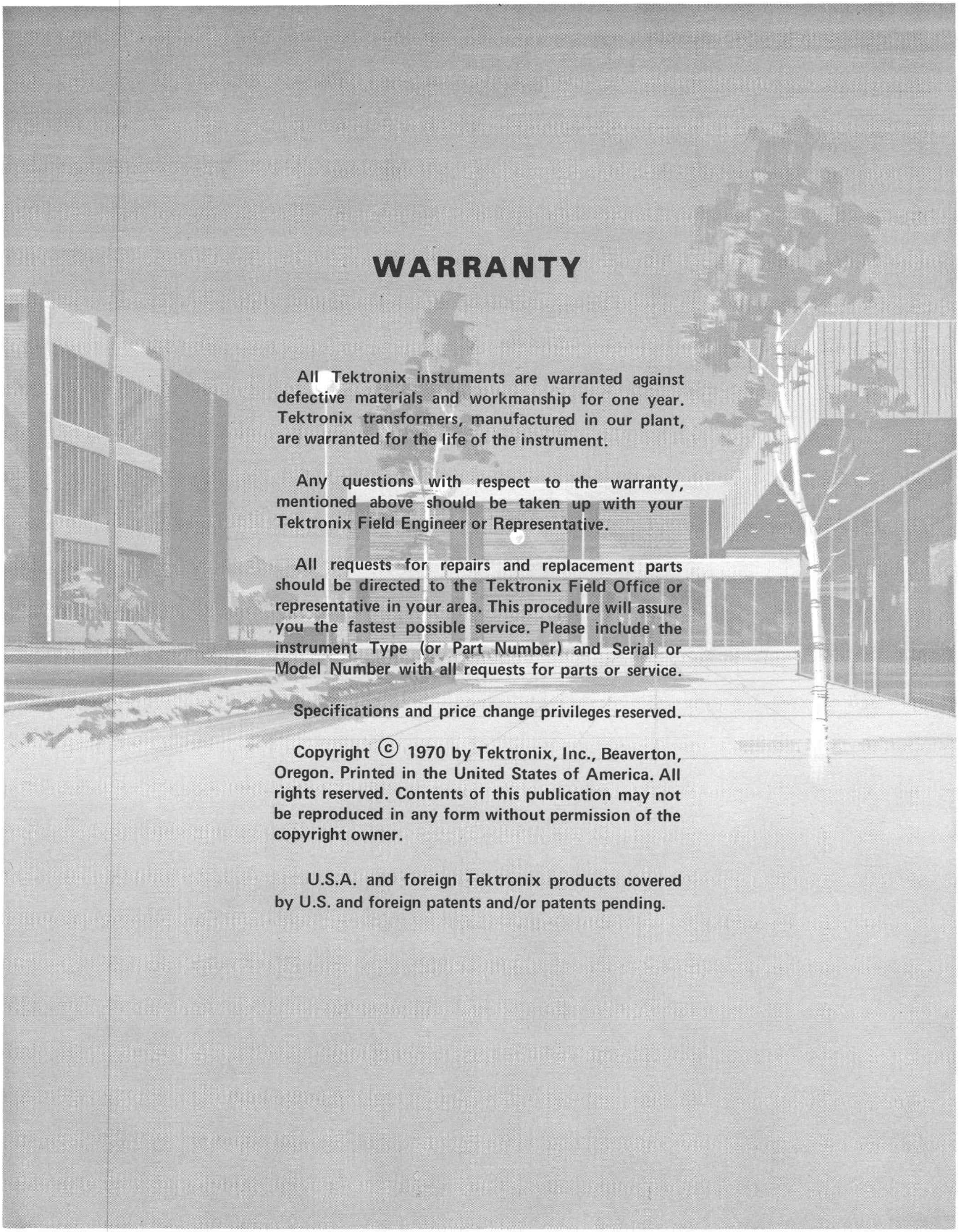
TYPE 142/R142

PAL TEST SIGNAL GENERATOR

Tektronix, Inc. • P. O. Box 500 • Beaverton, Oregon 97005 • Phone 644-0161 • Cables: Tektronix

070-1031-00

970



WARRANTY

All Tektronix instruments are warranted against defective materials and workmanship for one year. Tektronix transformers, manufactured in our plant, are warranted for the life of the instrument.

Any questions with respect to the warranty, mentioned above should be taken up with your Tektronix Field Engineer or Representative.

All requests for repairs and replacement parts should be directed to the Tektronix Field Office or representative in your area. This procedure will assure you the fastest possible service. Please include the instrument Type (or Part Number) and Serial or Model Number with all requests for parts or service.

Specifications and price change privileges reserved.

U.S.A. and foreign Tektronix products covered by U.S. and foreign patents and/or patents pending.

TABLE OF CONTENTS

		page
SECTION 1	TYPE 142/R142 SPECIFICATION	
	General Information	1-1
	Electrical Characteristics	1-2
	Staircase Signal (Table 1-1)	1-2
	Color Bar (Table 1-2)	1-3
	Sync (Table 1-3)	1-4
	Convergence Pattern (Table 1-4)	1-6
	Power Supply (Table 1-5)	1-6
	Physical	1-7
	Environmental Characteristics	1-7
	Environmental (Table 1-7)	1-7
	Accessories	1-7
SECTION 2	OPERATING INSTRUCTIONS	
	Installation	2-1
	Basic Information	2-2
	Controls and Connectors	2-2
	First Time Operation	2-9
	Glossary of Terms	2-18
SECTION 3	CIRCUIT DESCRIPTION	
	Introduction	3-1
	Generating Output Signals	3-1
	Generating Modulated Staircase	3-3
	Generating Color Bar	3-6
	Generating PAL Pulse	3-7
	Integrated Circuits	3-7
	Subcarrier Oscillator & Output	3-13
	Subcarrier and Sync Source Switching	3-15
	Line Timing	3-17
	Field Timing	3-21
	Bar Timing	3-22
	Staircase	3-26
	Color Bar Drive	3-28
	Modulator	3-30
	Video Out	3-32
	Output Amplifiers	3-33
	Crosshatch and Dot Generator	3-34
	PAL Lock	3-36
	Low Voltage Power Supply	3-39

		page
SECTION 4	MAINTENANCE	
	Introduction	4-1
	Preventive Maintenance	4-1
	Corrective Maintenance	4-2
	Troubleshooting	4-4
	Circuit Boards	4-11
SECTION 5	PERFORMANCE CHECK/CALIBRATION	
	Introduction	5-1
	Test Equipment Required	5-1
	Calibration Record and Index	5-2
	Performance Check/Calibration Procedure	5-5
SECTION 6	RACKMOUNTING	
	Rackmounting Instructions	6-1
SECTION 7	ELECTRICAL PARTS LIST	
	Abbreviations and Symbols	
	Parts Ordering Information	
	Index of Electrical Parts List	
	Electrical Parts List	
SECTION 8	DIAGRAMS AND MECHANICAL PARTS ILLUSTRATIONS	
	Diagrams	
	Mechanical Parts Illustrations	
SECTION 9	MECHANICAL PARTS LIST	
	Mechanical Parts List Information	
	Index of Mechanical Parts Illustrations	
	Mechanical Parts List	
	Accessories	

CHANGE INFORMATION

Abbreviations and symbols used in this manual are based on or taken directly from IEEE Standard 260 "Standard Symbols for Units", MIL-STD-12B and other standards of the electronics industry. Change information, if any, is located at the rear of this manual.

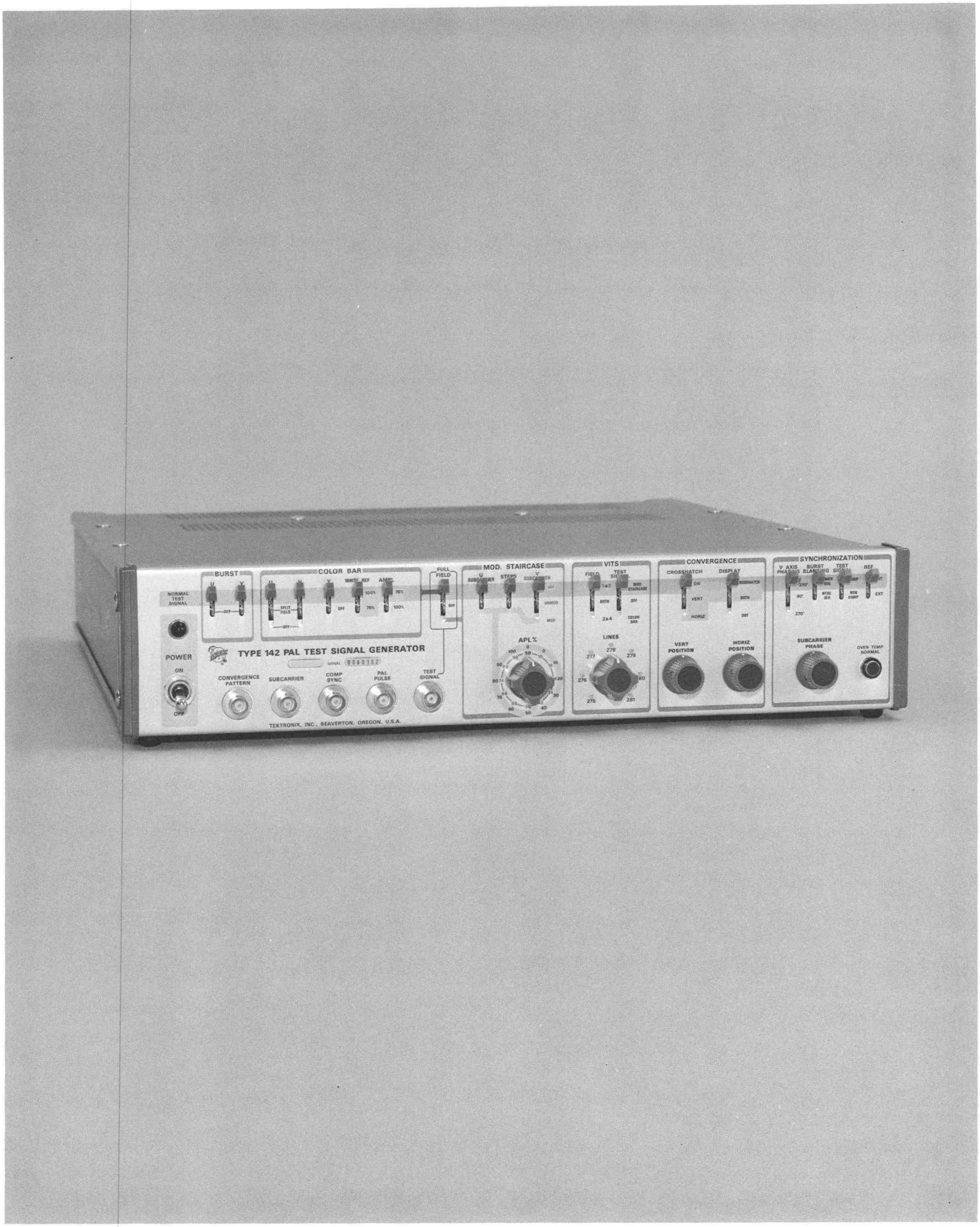


Fig. 1-1. The Type 142 PAL Test Signal Generator.

SECTION 1
TYPE 142/R142 SPECIFICATION

Change information, if any, affecting this section will be found at the rear of the manual.

General Information

The Tektronix Types 142 and R142 PAL[1] Test Signal Generators[2] are a compact, solid-state source of high-quality television test signals for 525-line, 60 Hz-field standard PAL color TV systems. Combined in one compact unit are the test signals needed to accurately test, evaluate, and adjust laboratory and standard broadcast color video equipment. Each test signal not only strictly adheres to industry standards, but also provides additional refinements to enhance the accuracy and range of measurements which can be made. The self-contained sync generator includes a temperature controlled color standard with excellent frequency stability. Digital integrated circuits are extensively used to achieve stability, accuracy, and reliability.

Three operating modes provide PAL color bars, 5 step staircase with APL[3] and a 5 step staircase with variable APL. A convergence pattern signal is available independent of and separate from other test signals.

PAL Color Bars. The standard color bar output is a full-field test signal appearing on every active line, and consists of 75% or 100% amplitude color bars in descending luminance order with 50 millivolts setup. With 75% amplitude, the white reference amplitude, which precedes the yellow bar, may be selected at 75% or 100% levels. The 100% white bar amplitude level permits a convenient check of relative chrominance/luminance gain by comparing the peak amplitudes of the yellow, cyan, and white bars.

Staircase. The staircase signal is particularly useful with a Tektronix Type 522 Vectorscope to measure differential phase and gain. Luminance channel linearity may also be measured with an oscilloscope and a Tektronix Video Staircase Differentiator (Part No. 015-0075-00).

---

[1] Phase Alternation Line System.

[2] **Since the two models of the generator are electrically identical, the bench model (Type 142) is used for the text illustrations in this manual unless noted otherwise.**

[3] **Average Picture Level. Defined as the average signal level with respect to the blanking level, during active picture scanning time, expressed as a percentage of the difference between blanking and reference white levels.**

The PAL subcarrier component of the staircase signal is 140 millivolts peak to peak in amplitude and is accurately phased to 0°. Thus, the subcarrier lies along the + U axis on all lines carrying the staircase signal. If desired, the subcarrier may be switched off. The last step of the signal (at white level) is double width so it can be viewed with and without subcarrier to detect clipping in the white direction.

A new signal capability provides a means to check luminance signal distortion caused by rectification of the subcarrier signal. When the variable APL mode is selected, an additional component consisting of subcarrier, phased to lead burst by 90°, may be added to the low-frequency lines either as a constant 30 millivolt amplitude signal or it may be amplitude-modulated to produce a 30, 300, and 600 millivolts signal. The modulated subcarrier signal position is useful for determining the effects of subcarrier rectification upon luminance signals at all APL's through the entire TV system. The constant 30 millivolt amplitude subcarrier signal is useful for eliminating unnecessary portions of the display when making differential phase measurements.

Vertical Interval Test Signals. Provision is made for insertion of either the staircase or the color bar, as a vertical interval test signal, on any line from 12 through 18 of fields 1 and 3, or any line from 275 through 281 in fields 2 and 4. The phase of the burst (and all other subcarrier frequency components of the test signal outputs) may be varied 360° with respect to the subcarrier frequency source (internal or external).

With the 75% amplitude full-field color bar signal or the modulated staircase signal inserted on an appropriate line of both fields, it is possible to test an entire video system including transmitters for differential phase and gain.

Sync Generator and Color Standards. The EIA sync generator circuitry is largely digital, using integrated circuit counting functions. The usual frequency multiplier circuits and their attendant problems have been avoided, resulting in exceptional time stability. Internal controls permit some variation of widths, including burst flag timing.

The color standard has a proportional control oven for the quartz crystal and the entire oscillator circuit. A front-

panel lamp indicates proper operation of the oven. When the internal color standard is used, the phase of the color subcarrier output is variable over a 360° range with respect to the phase of the burst contained in the video output. When an external color standard is used, the phase of the burst (and all other subcarrier frequency components of the test signal outputs) may be varied 360° to the external subcarrier source.

Convergence Pattern. The convergence pattern signal is provided separately and independent from the other test signals. It is useful for measuring picture monitor or camera scanning linearity, aspect ratio, and geometric distortion. Displays available include crosshatch, vertical lines only, horizontal lines only, dots only, and crosshatch plus dots (dots appear centered in the rectangles formed by the crosshatch pattern).

ELECTRICAL CHARACTERISTICS

The following performance requirements apply over an ambient temperature range of 0°C to +50°C, after a warm-up time of 10 minutes. A 20-minute warm-up is required for rated accuracies at 0°C ambient temperature.

TABLE 1-1

Staircase Signal

Characteristic	Performance Requirement
Luminance Component	The staircase signal is similar to that in volumn 5 of CCIR, recommendations 421-1 and 451, but differs in the following respect: a white reference signal is provided and the subcarrier is phased to the + U axis.
Step Amplitude	140 millivolts within 1%.
5 Step Amplitude	700 millivolts within 1%.
Step Risetime	260 ns within 15%.
Aberrations	Within 2% of step amplitude.
Step Duration	
Blanking Level	13.3 μs within 5%.
White Level	13.3 μs within 5%.
Intermediate Level	6.6 μs within 5%.
Chrominance Component	
Amplitude	140 millivolts within 3%.
Phase	0°

TABLE 1-1 (cont)

Characteristic	Performance Requirement
Differential Phase	
10% APL	0.1° or less.
50% APL	0.1° or less.
90% APL	0.1° or less.
Differential Gain	
10% APL	0.5% or less.
50% APL	0.5% or less.
90% APL	0.5% or less.
Subcarrier Envelope	
Duration	39 μs within 5%.
Risetime	375 ns within 15%.
VAR APL	Staircase signal on every fifth line, and the same line each frame.
Luminance Level Range	0 to 700 millivolts in 10 equal increments within 2%.
Subcarrier Component	
OFF	No subcarrier.
UNMOD	30 millivolts within 1.5 millivolts (at 90°) during active line time of 52.3 μs.
MODULATED SUBCARRIER	30 millivolts within 1.5 millivolts for the first and last 13.2 μs of active line time.
	300 millivolts within 3% for the second 13.2 μs of active line time.
	600 millivolts within 3% for the third 13.2 μs of active line time.
	Incidental phase error between 30, 300 and 600 millivolts signals are within 0.5°.

TABLE 1-2

Color Bar

Characteristic	Performance Requirement			
Luminance and Chrominance Accuracy	Absolute amplitudes of luminance signal, setup, and sync are within 1% or 1.5 millivolts, whichever is greater, with respect to blanking.			
	Absolute amplitudes of all subcarrier frequency components (Chrominance, U and V) are within 3%.			
	Relative amplitudes of all subcarrier frequency components are within 1% or 1.5 millivolts, whichever is greater of the red chrominance bar.			
	REFERENCE AMPLITUDES (mV, P-P)			
100% Amplitude	Luminance	Chrominance	U	V
Peak White	700.0	2.5 or less	-----	-----
White	700.0	2.5 or less	-----	-----
Yellow	625.9	582.5	576.8	130.0
Cyan	505.7	821.9	191.6	799.2
Green	431.6	767.7	376.2	669.2
Magenta	318.4	767.7	376.2	669.2
Red	244.3	821.9	191.6	799.2
Blue	124.1	582.5	576.8	130.0
Black	50.0	2.5 or less	-----	-----
Blanking	0.0	2.5 or less	-----	-----
Sync	−300.0	2.5 or less	-----	-----
75% Amplitude				
Peak White	700.0	2.5 or less	-----	-----
White	537.5	2.5 or less	-----	-----
Yellow	481.9	436.9	425.9	97.5
Cyan	391.8	616.4	143.7	599.4
Green	336.2	575.8	282.2	501.9
Magenta	251.3	575.8	282.2	501.9
Red	195.7	616.4	143.7	599.4
Blue	105.6	436.9	425.9	97.5
Black	50.0	2.5 or less	-----	-----
Blanking	0.0	2.5 or less	-----	-----

TABLE 1-2 (cont)

Characteristic	Performance Requirement
Bar Width	6.6 μs within 5%.
Risetime (White Bar)	115 ns within 15%.
White Reference	100% amplitude normal; or 75%.
Chrominance	
Time Difference between Luminance and Chrominance	20 ns or less.
Risetime	375 ns within 15%.
U, V Quadature Error	0.5° or less.
V Axis Phase Switcher	0.5° or less.
Residual Subcarrier	At least 52 dB below 1 volt on White, Black.
Aberrations	Within 4% peak to peak of 1 volt.
Spurious Subcarrier (between burst and white)	At least 52 dB below 1 volt when viewed on a Type 529 except 30 dB during sync and at the end of H Blanking.
Other Spurious Subcarrier (at center of line blanking pulse)	At least 52 dB below 1 volt when viewed on a Type 529 except 30 dB during sync and at the end of H Blanking.
TEST SIGNAL	
Return Loss	At least 30 dB.
Isolation	
Passive	Either open or short of one output will cause an output level change at the other connector of less than 1%; i.e., 40 dB for all other components of the signal.
Active (Non-Coherent Crosstalk)	A signal introduced to one output connector will be attenuated by at least 40 dB at the other connector for signals between +0.5 and −4.0 volts, at or below color subcarrier frequency.
Front-porch	1.54 μs within 0.05 μs measured at 10% from blanking.

TABLE 1-3

Sync

Characteristic	Performance Requirement
COMP SYNC	
Output	
Amplitude	4 volts peak to peak within 0.2 volt into 75 ohms.
Return Loss	At least 30 dB to 5 MHz.
Isolation	
Passive	Either open or short of one output will cause an output level change at the other connector of less than 1%; i.e., 40 dB for all components of the signal.
Active (Non-Coherent Crosstalk)	A signal introduced to one output connector will be attenuated by at least 30 dB at the other connector for signals between +3.0 and −0.5 volts, at or below color subcarrier frequency.
Rise and Fall-time	115 ns within 10%.
Line Sync Duration	4.71 μs within 0.05 μs measured at 10% from blanking level.
Line Period	63.56 μs[4]
Equalizing Pulse	
Duration	2.33 μs within 0.5 μs measured at 10% from blanking level.
Sequence Duration	
First	3 lines[4]
Second	3 lines[4]
Field Sync Pulse	
Duration	27.3 μs within 0.2 μs measured at 10%.
Sequence Duration	3 lines[4]

TABLE 1-3 (cont)

Characteristic	Performance Requirement
Interval Between	4.5 μs within 0.2 μs measured at 10% from blanking level.
Field Period	262.5 lines[4]
Input (loop-through)	
Amplitude	At least 2 volts peak to peak.
Return Loss	At least 46 dB.
SUBCARRIER	
Output	
Amplitude	2 volts peak to peak within 0.2 volt into 75 ohms.
Return Loss	At least 30 dB.
Isolation	
Passive	Either open or short of one output will cause an output level change at the other connector of less than 1%; i.e., 40 dB for all components of the signal.
Active (Non-Coherent Crosstalk)	A signal introduced to one output connector will be attenuated by at least 40 dB at the other connector for signals between +0.5 and −4.0 volts, at or below color subcarrier frequency.
Frequency	3.575611 MHz within 5 Hz.
Input (Loop-through)	
Amplitude	At least 1 volt peak to peak.
Return Loss	At least 46 dB.
HORIZ DRIVE	
Amplitude	4 volts peak to peak within 5% into 75 ohms.
Pulse Duration	6.35 μs within 5%.
Rise and Fall-time	115 ns within 10%.
Return Loss	At least 30 dB.

TABLE 1-3 (cont)

Characteristic	Performance Requirement
VERT DRIVE	
Amplitude	4 volts peak to peak within 5% into 75 ohms.
Pulse Duration	10.5 lines[4]
Rise and Fall-time	115 ns within 10%.
Return Loss	At least 30 dB.
COMP BLANKING	
Amplitude	4 volts peak to peak within 5% into 75 ohms.
Duration	
Line Blanking	11.1 μs[4]
Field Blanking	21 lines[4]
Rise and Fall-time	115 ns within 10%.
Return Loss	At least 30 dB.
PAL PULSE	Amplitude and phasing are internally selected and independent of front-panel V AXIS PHASING switch.
Output	
Amplitude	4 volts within 0.2 volt into 75 ohms.
Duration	4.7 μs within 0.2 μs.
Rise and Fall-time	115 ns within 15%.
Phasing	Negative transition is coincident with leading edge of line sync pulse on lines with 135° or 225° (internally selected) burst phasing.
Return Loss	At least 30 dB.
Isolation	
Passive	Either open or short of one output will cause an output level change at the other connector of less than

TABLE 1-3 (cont)

Characteristic	Performance Requirement
	1%, i.e., 40 dB for all components of the signal.
Active (Non-Coherent Crosstalk)	A signal introduced to one output connector will be attenuated by at least 30 dB at the other connector for signals between +3 and −0.5 volts, at or below color subcarrier frequency.
Input	
Amplitude	At least 2 volts peak to peak.
Return Loss	At least 46 dB.
Pulse Duration	At least 4 μs.
BURST FLAG	
Amplitude	4 volts within 0.2 volt into 75 ohms.
Duration	2.3 μs within 5%.
Return Loss	At least 30 dB.
Delay from H Sync	5.0 μs within 5%.
BURST	
Half Amplitude Duration of Envelope	2.22 μs to 2.61 μs, 8 cycles minimum.
Breezeway	At least 379 ns from 10% point on trailing edge of sync to 10% point on leading edge of burst.
Burst Component	
V	212 mV within 3%.
U	212 mV within 3%.
Total	300 mV within 3%.
Amplitude Ratio $\frac{U}{V}$	1.00 within 1%.
Amplitude on Successive Lines	Smaller is between 97% and 100% of the larger.

TABLE 1-3 (cont)

Characteristic	Performance Requirement
Phasing	135° within 1° and 225° within 1° on successive lines. Phasing between successive burst is 90° within 1°.

[4]Digitally determined from 3.575611 MHz.

TABLE 1-4

Convergence Pattern

Characteristic	Performance Requirement
CONVERGENCE PATTERN	
Setup	50 mV within 5%.
Sync Amplitude	300 mV within 5%.
Pulse Amplitude	700 mV within 5%.
Amplitude (overall)	1 volt peak to peak within 5%.
Return Loss	At least 30 dB.
Isolation	
Passive	Either open or short of one output will cause an output level change at the other connector of less than 1%; i.e., 40 dB for all components of the signal.
Active (Non-Coherent Crosstalk)	A signal introduced to one output connector will be attenuated by at least 40 dB at the other connector for signals between +0.5 and −4.0 volts, at or below color subcarrier frequency.
Risetime	115 ns within 10%.
Crosshatch Vertical Lines	
Repetition Rate	315 kHz.
Pulse Time Position Range	At least 3.2 μs.

TABLE 1-4 (cont)

Characteristic	Performance Requirement
Pulse Polarity	Positive
Number of Unblanked Pulses	16 or 17 (depends on setting of POSITION control).
Crosshatch Pulse Duration	225 ns within 15%.
Dot Pulse Duration	350 ns within 15%.
Crosshatch Horizontal Lines	
Repetition Rate	900 Hz[4]
Pulse Time Position Range	At least 1.1 ms.
Pulse Polarity	Positive
Number of Unblanked pulses	13 to 14 (depends on setting of POSITION control).
Crosshatch Pulse Duration	1 line at field rate.[4]
Dot Pulse Duration	3 lines per frame.[4]
Displays Available	Crosshatch
	Vertical Lines only.
	Horizontal Lines only.
	Dots
	Crosshatch plus Dots.

TABLE 1-5

Power Supply

Characteristic	Performance Requirement
Power Connection	The instrument is provided with a three-wire power cord with a three-terminal polarized plug for connection to the power source. The third wire is directly connected to the instrument to protect operating personnel as recommended by

TABLE 1-5 (cont)

Characteristic	Performance Requirement
	national and international safety codes.
Line Voltage Range	
115 VAC Low	90 V to 110 V.
115 VAC Medium	104 V to 126 V.
115 VAC High	112 V to 136 V.
Crest Factor	1.35
230 VAC Low	180 V to 220 V.
230 VAC Medium	208 V to 252 V.
230 VAC High	224 V to 272 V.
Line Frequency Range	48 Hz to 66 Hz.
Power	55 W Maximum until OVEN TEMP NORMAL indicator is on.

TABLE 1-6

Physical

Characteristic	Information
Finish	Cabinet is blue-vinyl paint. Front-panel is anodized aluminum.
Dimensions	
Bench Model (overall)	
Height	3.82 inches.
Length	19.10 inches.
Width	17.85 inches.

TABLE 1-6 (cont)

Characteristic	Information
Rackmount Model (overall)	
Height	3.47 inches.
Length	19.66 inches.
Width	19.00 inches.

ENVIRONMENTAL CHARACTERISTICS

The following environmental test limits apply when tested in accordance with the recommended test procedure. This instrument will meet the electrical performance requirements given in this section following an environmental test. Complete details on environmental test procedures, including failure criteria, etc., may be obtained from Tektronix, Inc. Contact your local Tektronix Field Office or representatives.

TABLE 1-7

Environmental

Characteristic	Information
Temperature	
Non-Operating Range	-40°C to $+65^\circ$C.
Operating Range	0°C to $+50^\circ$C.
Altitude	
Non-Operating Range	To 50,000 feet.
Operating Range	To 15,000 feet.

ACCESSORIES

Standard accessories supplied with this instrument can be found on the last page of the Mechanical Parts List illustrations. For additional accessories, see the current Tektronix, Inc. catalog.

NOTES

SECTION 2
OPERATING INSTRUCTIONS

Change information, if any, affecting this section will be found at the rear of the manual.

INSTALLATION

Rackmounting

Complete information for mounting the Type 142 in a rack is given in Section 6.

Operating Voltage

The Type 142 may be operated from either a 115-V or 230-V line voltage source. Quick-change line-voltage selector plugs, located under the fuse cover on the rear panel, change the transformer primary connections so that the instrument can operate from one line voltage or the other (115 V or 230 V). In addition, the plugs permit one of three line voltage operating ranges to be selected. Table 2-1 lists all the voltage ranges that enable the instrument DC power supplies to regulate properly.

TABLE 2-1

115/230 Voltage Selector Plug Position	Range Selector Plug Position	Nominal Line (center) Voltage	Line Voltage Operating Range[1]
115 V	LO (Low)	100 VAC	90 to 110 VAC
	M (Medium)	115 VAC	104 to 126 VAC
	HI (High)	124 VAC	112 to 136 VAC
230 V	LO (Low)	200 VAC	180 to 220 VAC
	M (Medium)	230 VAC	208 to 252 VAC
	HI (High)	248 VAC	224 to 272 VAC

[1] **Applicable when the line contains less than 2% total distortion.**

To convert to a different line voltage, proceed as follows:

1. Disconnect the Type 142 from the power source.

2. Unscrew the two captive screws holding the fuse cover. Remove the cover and attached fuses.

3. To convert to a different line voltage (115 to 230 V), pull out the 115/230 Voltage Selector plug. Rotate the plug 180° and insert it into the opposite set of holes. The 115/230 Voltage Selector plug is located in the upper position for 115-V operation and in the lower position for 230-V operation. (See Fig. 2-1.)

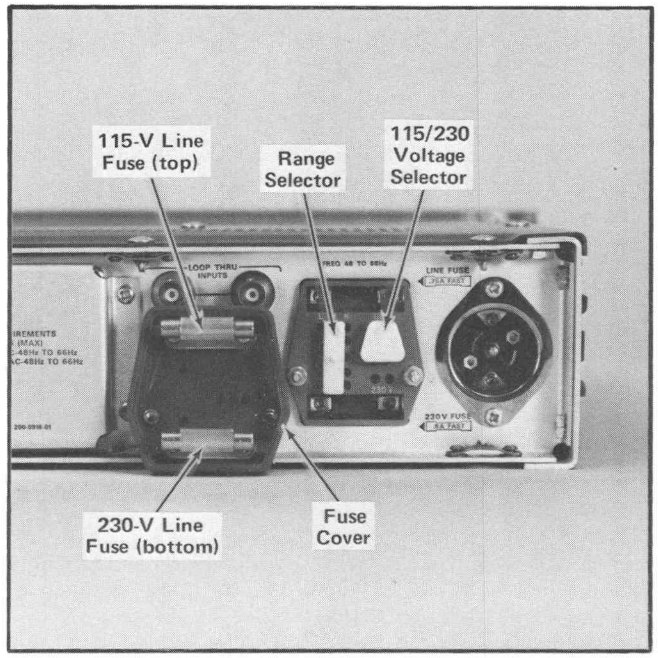


Fig. 2-1. Location of Range and Voltage Selector plugs with fuse cover removed. The plugs as shown are set for 115-V medium range operation.

4. To change the line-voltage operating range (LO, M or HI), pull out the Range Selector plug and insert it in the desired hole locations. Select a range with a center voltage (see column 3 in Table 2-1) closely corresponding to the line voltage that will be applied in regular instrument operation.

5. Re-install the cover with two captive screws and fuses. Be sure the cover fits firmly against the rear panel. This indicates that the line fuses are seated properly in fuse clips.

6. Before applying power to the instrument, check that the indicating tabs on the selector plugs protrude through

the proper holes in the cover for the correct line voltage and the proper operating range.

CAUTION

The Type 142 should not be operated with the 115/230 Voltage Selector and/or Range Selector plugs in the wrong position for the line voltage applied. Operation of the instrument with either plug in the wrong position may cause incorrect operation or damage to the instrument.

BASIC INFORMATION

Frequent check-out of color broadcast equipment is essential in providing realistic and accurate presentation of taped or live color scenes. In addition, rapid check-out of the signal monitoring instruments is highly desirable.

Type 142 provides a high-quality composite video signal complete with color components, suitable for checking calibration and operation of vectorscopes and TV waveform monitors.

The various components which comprise the composite color video signal can be added or removed from the composite signal by front-panel operational controls on the Type 142. This permits the simulation of various broadcast equipment troubles, such as loss of sync signals, U or V components, etc.

The Type 142 also serves as an excellent teaching aid, since the composite video signal can be "built up", one component at a time. Also, both the familiar staircase and color bar test signals are available as part of the composite video signal.

The split field color bar test signal is useful for checking luminance, hue and saturation levels. (See Fig. 2-2.)

Luminance is brightness as perceived by the eye. This is represented by the amplitudes of the step levels of the color bar signal between black and white levels. Since the eye is more sensitive to green and less to blue light of equal energy, green is a bright color, blue is a dark color as conveyed by the luminance signal to monochrome TV receivers. The color bar steps are therefore arranged in descending luminance order starting with yellow, the brightest color and ending with blue, the least bright color.

Chrominance consists of two additional quantities; hue and saturation. Hue is the attribute of color perception that determines whether the color is red, blue, green, or some other color. White, black and gray are not considered hues. In color TV systems, the hue is encoded as a phase angle of the signal with respect to a reference frequency (burst signal). (See Fig. 2-3A.)

Saturation is the degree to which a color (or hue) is diluted by white light. Percentage of saturation is used to distinguish between vivid and weak shades of the same hue. For example, vivid red is highly saturated and pink or pastel red has little saturation. One-hundred percent saturation represents full hue with no white dilution. In a vector display, saturation is indicated by the length of the vector. (See Fig. 2-3B.)

The color bar and modulated staircase test signals are illustrated in Fig. 2-4. The color bar test signal is useful for checking the overall performance of a color television system. The color bar contains luminance, hue, and saturation levels. The staircase consists of 5 steps (6 levels), each of which is modulated by the subcarrier frequency (3.575611 MHz). The steps are equally spaced between black level and white level. Staircase test signals are useful for checking presence of non-linearity in video stages. Typical tests made with a modulated staircase are differential gain and differential phase.

Differential gain is a change in color subcarrier amplitude as a function of luminance. In the reproduced color picture, presence of differential gain will cause distortion of the saturation in the areas between light and dark portions of the screen.

Differential phase is a phase modulation of the chrominance signal by the luminance signal. With differential phase present, color (hue) will vary with scene brightness in the reproduced color picture.

CONTROLS AND CONNECTORS

Introduction

A brief description of the function or operation of the Type 142 controls and front- and rear-panel output connectors is provided here. (See Fig. 2-5.)

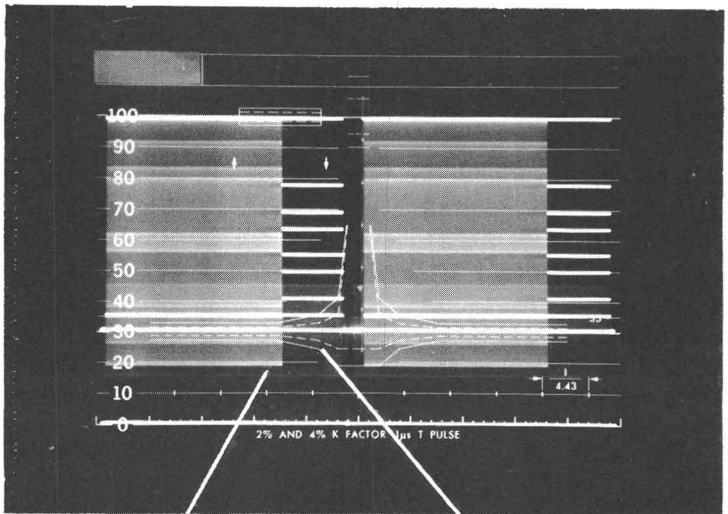
Front-Panel Controls

BURST — Consists of two lever switches to control individual elements of the burst signal.

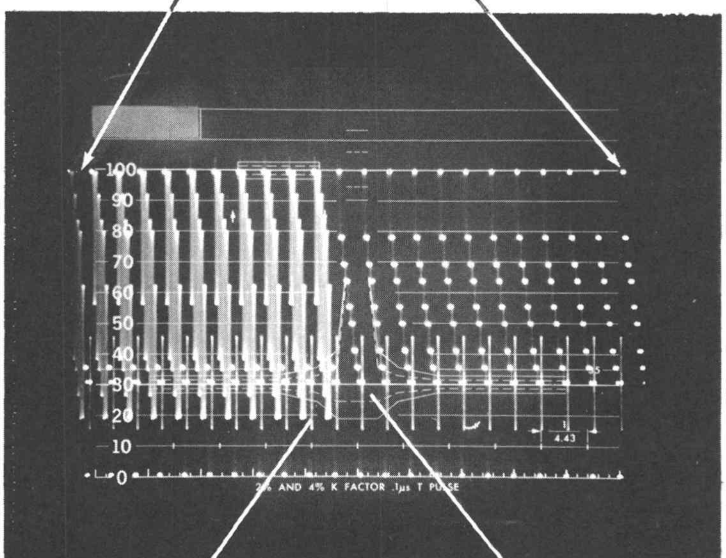
U Lever Switch:

Up position selects the U component of burst.

Down position turns off the U component.



(A) 2 Field Display of Split Field signal.



(B) Same as above, except magnified 25 times.

(C) Illustration of line just before and line just after field is split.

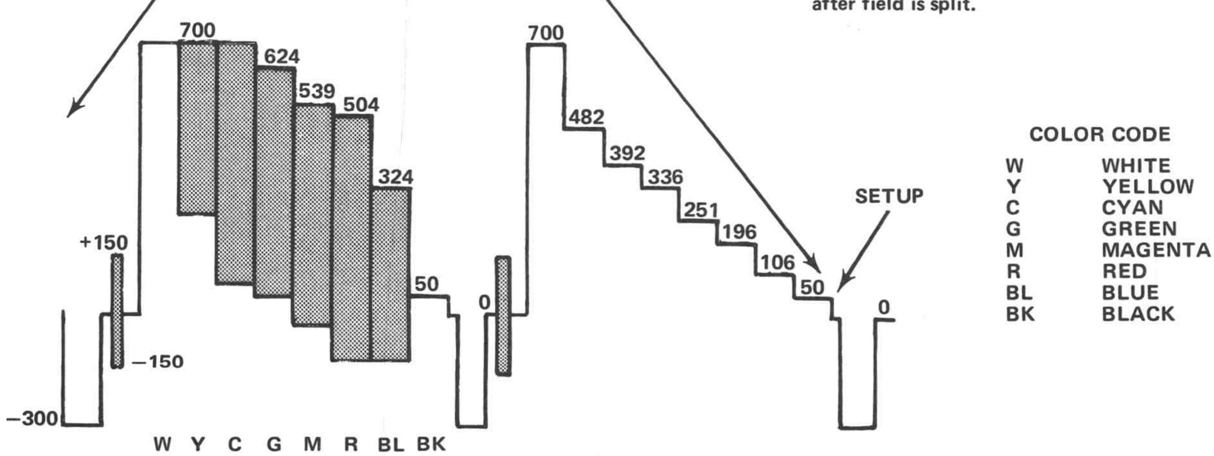
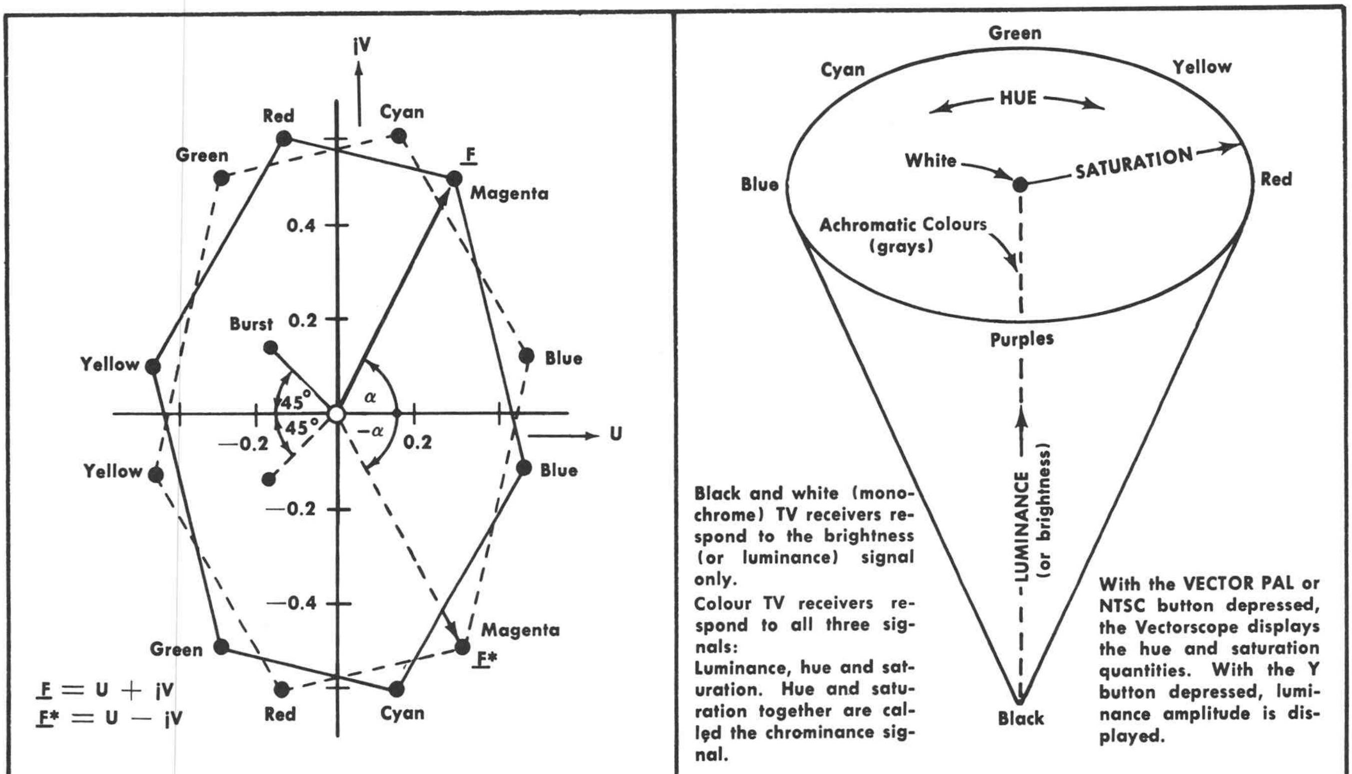


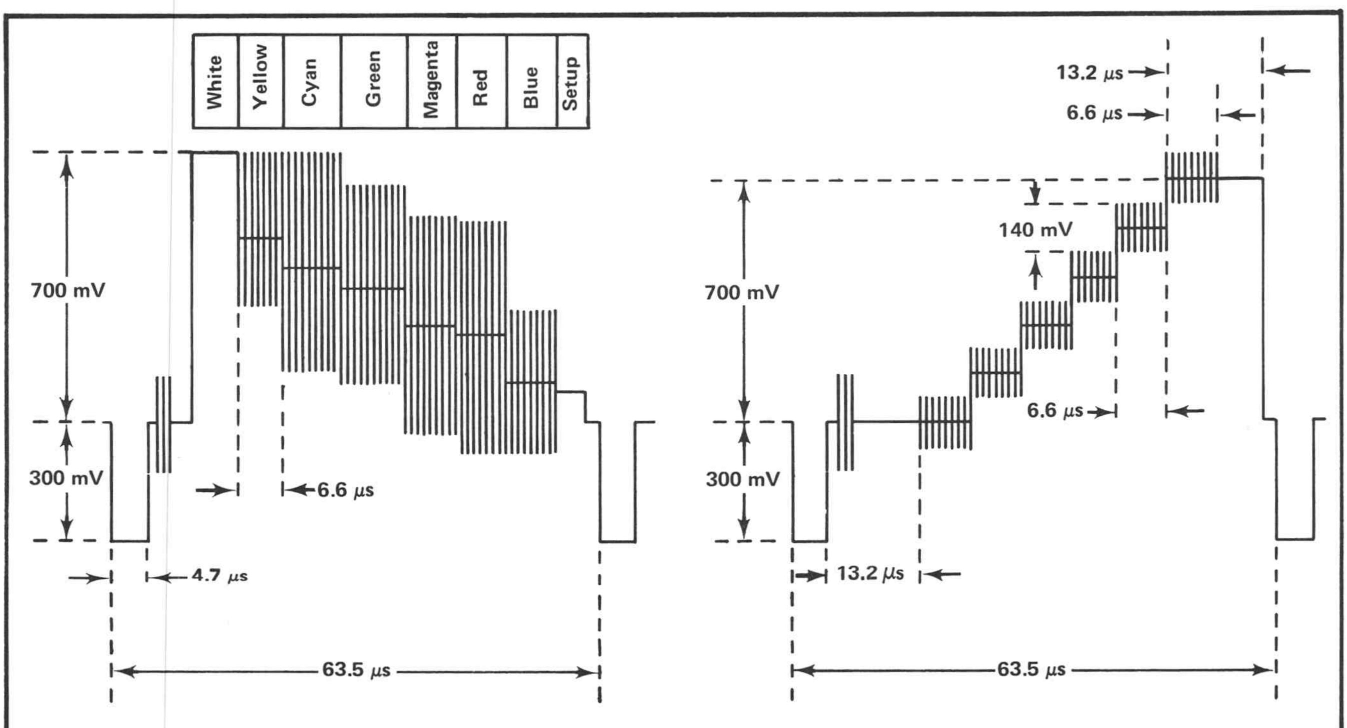
Fig. 2-2. Split field display of the color bar signal. The last 60 lines contain only the luminance components of the color bar signal. Numbers on the bottom illustration are amplitude levels (in millivolts).



(A) Standard color-phase vector diagram showing vector relationship among chrominance components.

(B) Conical three-dimensional representation of color concepts.

Fig. 2-3. Illustrations showing the relationship between the basic color concepts and the standard color-phase vector diagram.



(A) Color bar signal.

(B) Modulated staircase signal.

Fig. 2-4. Color bar and modulated staircase output signals.

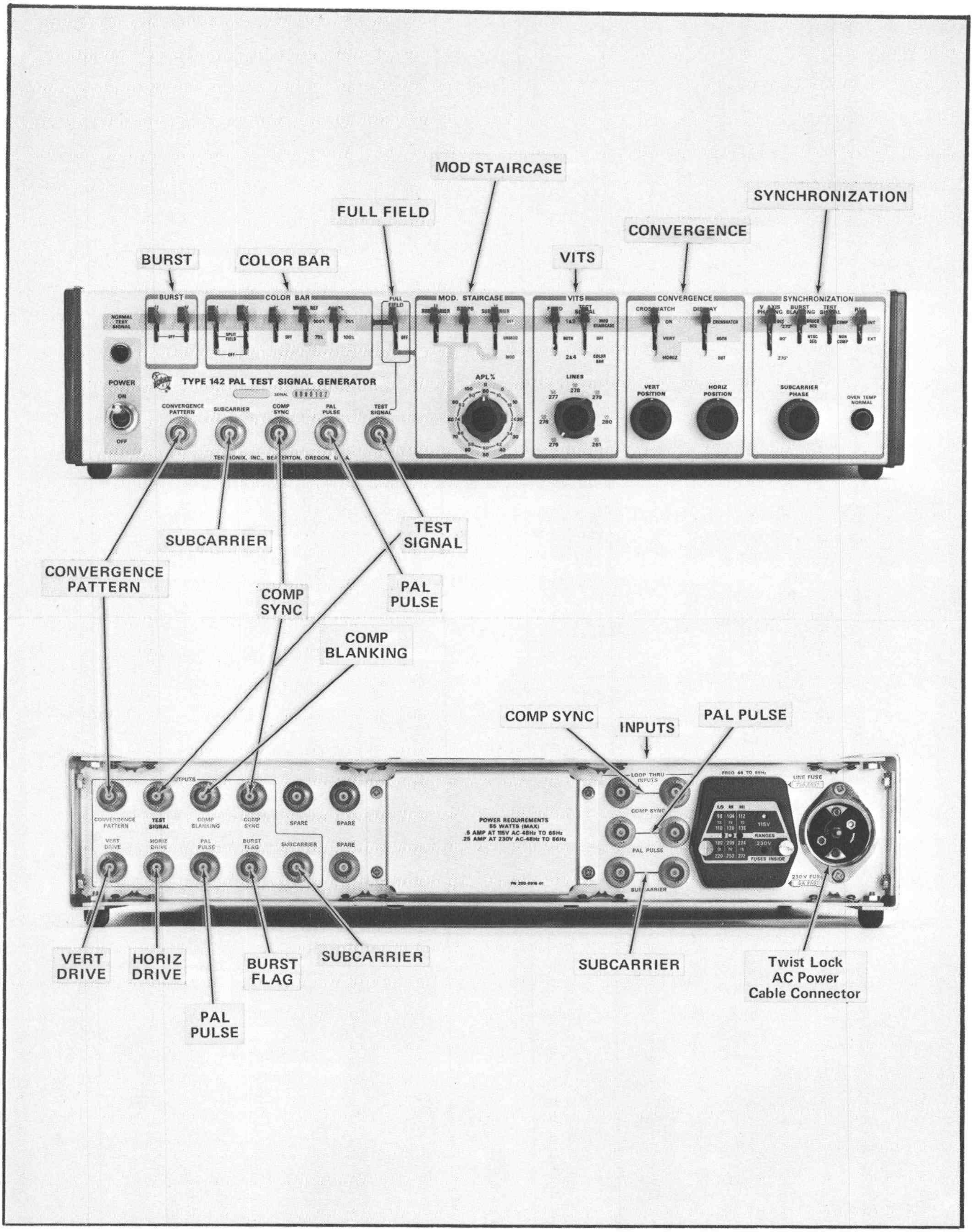


Fig. 2-5. Front- and rear-panel controls and connectors on the Type 142 PAL Test Signal Generator.

Front-Panel Controls

BURST (cont)

V Lever Switch:

Up position selects the V component of burst.

Down position turns off the V component.

COLOR BAR

Consists of five lever switches to control signal elements which make up the standard color bar test signal.

U Lever Switch:

Up position turns on the U (0°-180° axis) component of the color bar test signal.

Center position (SPLIT FIELD) removes the U component from the last 60 lines in each field.

Down position turns off the U component.

V Lever Switch:

Up position turns on the V (90°-270° axis) component of the color bar test signal.

Center position (SPLIT FIELD) removes the V component from the last 60 lines in each field.

Down position turns off the V component.

Y Lever Switch:

Up position turns on the luminance component of the color bar test signal.

Down position turns off the luminance component.

WHITE REF Lever Switch:

Controls the white reference level only when the AMPL switch is in the 75% (up) position.

100% (up) position selects white reference at the normal or 100% amplitude level.

75% (down) position selects white reference at a level that is 75% of the amplitude between setup and normal white level.

AMPL Lever Switch:

Controls the combined chrominance and luminance levels of the color bar signal (except white reference).

75% (up) position selects color bars with 75% amplitude, 100% saturation, and 50 mV setup. The white reference may be 75% or 100% as determined by the WHITE REF switch.

100% (down) position selects color bars with 100% amplitude, 100% saturation, and 50 mV setup. (WHITE REF switch has no control in this position).

FULL FIELD

A three-position lever switch which selects the signal appearing at the TEST SIGNAL output connectors.

Up position selects the color bar signal.

Center position (OFF) removes the video portion of the signal. Only sync, burst and VITS remain.

Down position selects the modulated linearity staircase signal.

MOD STAIRCASE

Consists of three lever switches and a twelve-position rotary switch to control the individual components of the staircase test signal.

U SUBCARRIER Lever Switch:

Up position applies a 140 mV subcarrier at 0° with respect to burst (180°) to the staircase test signal. Down position removes the subcarrier.

MOD STAIRCASE (cont.)

STEPS Lever Switch:

Up position applies staircase to test signal.

Down position removes the staircase.

V SUBCARRIER Lever Switch:

The V subcarrier may be applied to 4 out of 5 lines when the APL% rotary switch is in the 10 to 90 positions, or to every line when the U SUBCARRIER and STEPS switches are down.

The OFF position provides no subcarrier. The UNMOD position provides a 30 mV subcarrier with no amplitude or phase modulation. The MOD position provides a 30 mV, V subcarrier for the first and last 13.2 μs of each active line, a 300 mV, V subcarrier for the second 13.2 μs, and a 600 mV, V subcarrier for the third 13.2 μs.

APL% Rotary Switch:

The 50% position provides a staircase signal on each active video line. The 10 to 90 positions provide a staircase signal to one out of every five active video lines and a selectable luminance level on the remaining four. The V subcarrier can be applied to four of five lines (with the U SUBCARRIER and STEPS switches down, the APL is applied to every line including VITS STAIRCASE).

VITS

Consists of 2 three-position lever switches and a seven-position rotary switch to provide selection of the lines and the fields to which the vertical interval test signal is applied. Either color bar, APL, or staircase signal is available.

LINE Rotary Switch:

Provides selection of any line from line 12 through line 18 or line 275 through line 281 to which VITS is applied.

FIELD Lever Switch:

Provides selection of fields 1 and 3, fields 2 and 4, or both fields (1 and 3, 2 and 4) to which the VITS is applied.

TEST SIGNAL Lever Switch:

MOD STAIRCASE position provides a VITS consisting of a five step (six level) modulated staircase which can be modified by the U SUBCARRIER and STEPS lever switches. When the U SUBCARRIER and the STEPS switches are down, an APL signal is applied to the VITS which can be modified with the V SUBCARRIER switch and the APL% rotary switch.

OFF (center) position removes all signals from the VITS line and field location.

COLOR BAR (down) position provides a VITS consisting of a standard PAL color bar test signal which can be modified by the COLOR BAR lever switches.

CONVERGENCE

Consists of two lever switches and two potentiometers to control and position the display. The convergence signal is available at the CONVERGENCE PATTERN connector.

CROSSHATCH Lever Switch:

ON position provides a crosshatch display. (DISPLAY switch must be in CROSSHATCH or BOTH positions). VERT position provides vertical white bars only. HORIZ position provides horizontal white bars only.

DISPLAY Lever Switch:

The CROSSHATCH position provides a crosshatch display which can be modified by the CROSSHATCH switch. The BOTH position provides white dots centered in the rectangles formed

by crosshatch. The DOT position provides white dots only.

VERT POSITION Control:

Potentiometer control moves display vertically for convenient alignment with screen of display device.

HORIZ POSITION Control:

Potentiometer control moves display horizontally for convenient alignment with screen of display device.

SYNCHRONIZATION

Consists of four lever switches and a goniometer to control synchronization of signals.

V AXIS PHASING Switch:

90°/270° (up) position, V axis phasing alternates line by line between 90° and 270° according to standard PAL sequence. Line 9, field 1 is 90°.

90° (center) position, V axis phased at 90°.

270° (down) position, V axis phased at 270°.

BURST BLANKING Switch:

BRUCH SEQ (up) position selects Bruch sequence of burst blanking.

NTSC SEQ (down) position selects NTSC sequence of burst blanking. (Nine lines per field are blanked).

TEST SIGNAL Switch:

COMP (up) position applies composite sync to TEST SIGNAL output connectors.

NON-COMP (down) position removes composite sync from the TEST SIGNAL output connectors. (Composite sync is always present at the COMP SYNC output connectors).

REF Switch:

INT (up) position selects the internal timing relationships derived from the subcarrier.

EXT (down) position selects timing derived from externally applied sync, subcarrier, and PAL pulse.

SUBCARRIER PHASE Control:

Goniometer control varies the phase angle between chrominance on the composite video and the subcarrier reference present on the SUBCARRIER output whether internal or external.

POWER

Toggle switch turns main power ON and OFF.

Light: Indicates that the POWER switch is on and the instrument is connected to a line voltage source.

OVEN TEMP NORMAL LIGHT

When lighted, indicates that the Master Oscillator crystal oven is at normal operating termperature

Output Connectors

All output signals are via BNC type connectors, and have a 75 ohm source impedance. For proper operation each output, when in use must drive a 75 ohm load.

CONVERGENCE PATTERN (Front and Rear panel)	Provides a 1 V P-P composite video signal, consisting of composite sync and convergence pattern signals as selected by front-panel controls.
SUBCARRIER (Front and rear panel	Provides a 2 V P-P sine wave output at subcarrier frequency (3.575611 MHz).
COMP SYNC (front and rear panel)	Provides a 4 V composite sync pulse per EIA specifications.

COMP BLANKING (Rear panel)	Provides a 4 V negative-going composite blanking pulse per EIA specifications.
TEST SIGNAL (Front and rear panel)	Provides 1 V P-P composite video signal consisting of composite sync and video test signals as selected by front-panel controls (except CONVERGENCE controls).
PAL PULSE (Front and rear panel)	Provides a 4 V negative-going pulse for PAL encoders to maintain correct phase of V axis signals. (Amplitude and phasing are internally selectable, independent of V AXIS PHASING switch).
BURST FLAG (Rear panel)	Provides 4 V negative-going pulses coincident with burst.
HORIZ DRIVE (Rear panel)	Provides a 4 V negative-going pulse. Its leading edge is coincident with the start of line blanking.
VERT DRIVE (Rear panel)	Provides a 4 V negative-going pulse. Its leading edge is coincident with the start of vertical blanking.

Input Connectors

All input signals are via BNC type connectors and are loop-thru. For proper operation each input, when in use, must be terminated into 75 ohms.

SUBCARRIER (Rear panel)	Accepts a 3.575611 MHz signal 1 to 4 volts in amplitude.
COMP SYNC (Rear panel)	Accepts properly timed composite sync 2 to 4 volts in amplitude.
PAL PULSE (Rear panel)	Accepts a PAL pulse input signal with an amplitude of at least 2 V P-P, negative-going, and with a duration of at least 4 µs.

Test Setup Chart

Fig. 2-6 shows a drawing of the front- and rear-panel controls and connectors. This chart can be reproduced and used as a test setup record for special measurements and applications, or it may be used as a training aid for operation of the Type 142.

FIRST-TIME OPERATION

The following procedure demonstrates the use of the controls and connectors of the Type 142. Use of the Type 142 with two different display instruments is outlined for the convenience of the user. It is assumed that a video waveform monitor is available. A Vectorscope is essential if phase characteristics of the composite video output are to be observed. An oscilloscope is useful for observing sync, drive and other pulse outputs. It may be used to display all outputs except for phase characteristics.

Procedure 1

A Type RM529 Mod 188D Waveform Monitor is used as a display device in the following steps.

1. Check that the line voltage selector plugs are in proper positions for the line voltage to be applied. (See Installation). Connect the Type 142 to the power source and turn on the POWER switch.

2. Connect the TEST SIGNAL output on the Type 142 to the A Video Input connector on the Type RM529 through a 75-ohm coaxial cable. If the other A Video Input connector is not used, connect a 75-ohm terminating resistor to the unused connector.

3. While the instrument is warming up (at least 5 minutes), set the instrument front-panel controls to these positions:

Type 142

BURST switches	All up
COLOR BAR switches	All up
FULL FIELD	Up
MOD STAIRCASE switches	All up
APL%	50%
VITS switches	All up
LINES	15/278
CONVERGENCE switches	All up
SYNCHRONIZATION switches	All up
SUBCARRIER PHASE	As is

Type RM529 Mod 188D

Vertical:	
Input	A (AC COUPLED)
DC Restorer	On
Response	Flat
Volts Full Scale	1.0 (Calib)
Position	Centered
Calibrator	Full Scale
Focus	Sharp Trace

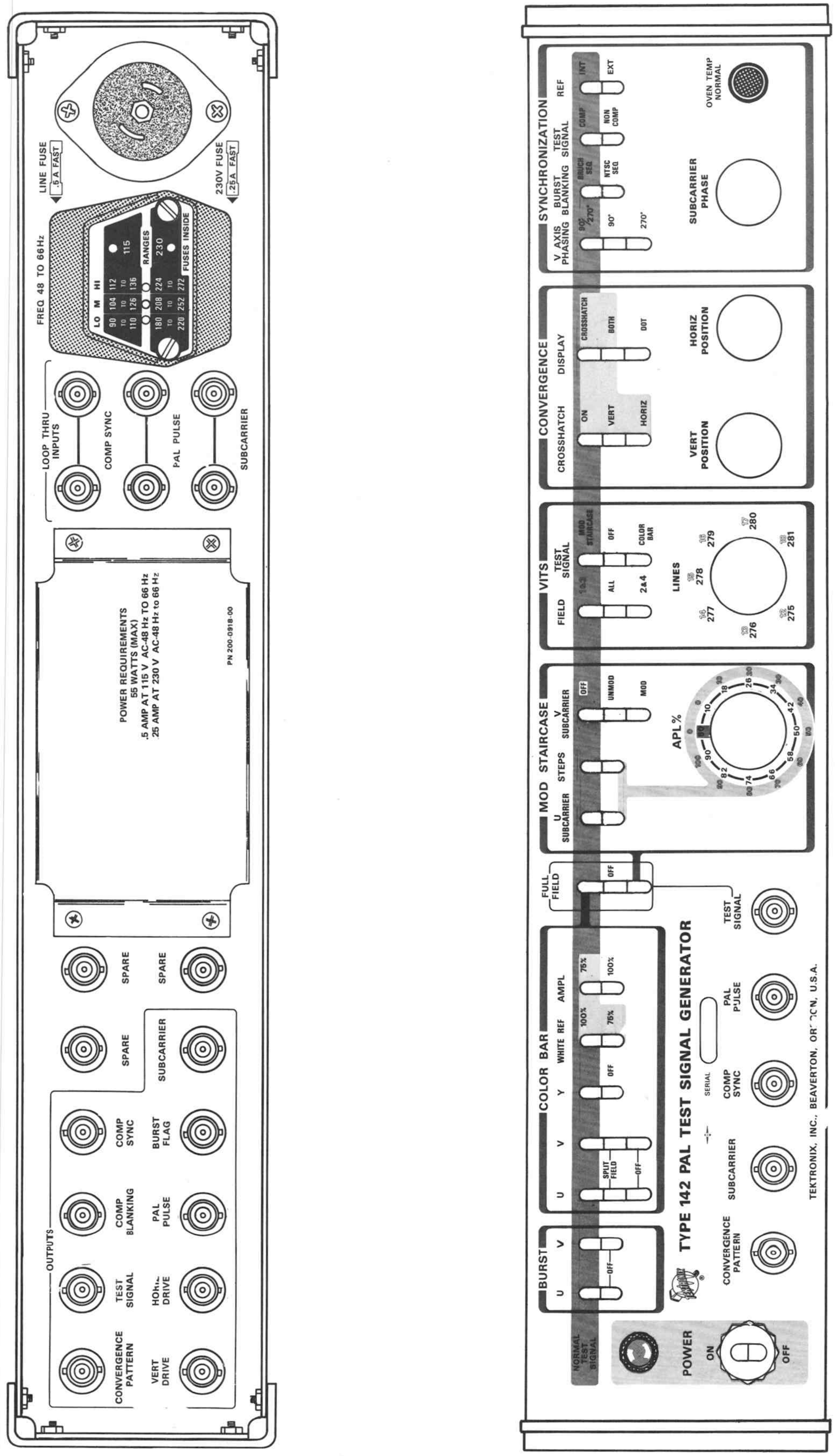


Fig. 2-6. Control and connector setup chart for Type 142/R142.

Ⓐ

Intensity	As desired
Scale Illum	Fully CW
Horizontal:	
Position	Centered
Line & Field Rate	525/60
Mag	X1
Variable	Calib
Line Selector	18
Field	One
PAL Frame Selector	Norm
Sync	Int

4. The display should consist of 2 lines of composite video, each containing a standard color bar test signal.

5. With the Type RM529 Vertical Position control, set the blanking level on the 30 graticule line. The sync tips should be at 0, the black level at 35, and the white level at 100. Burst whould be present between sync and the white luminance step. (See Fig. 2-7A.)

6. Change the COLOR BAR U and V switches to the down (OFF) position. Note that the display is now showing the luminance (Y) component of the color bar test signal. Return the U and V switches to the up position.

7. Change the COLOR BAR Y switch to the down (OFF) position. Note that the display is now showing only the chrominance components of the color bar test signal. Return the Y switch to the up position.

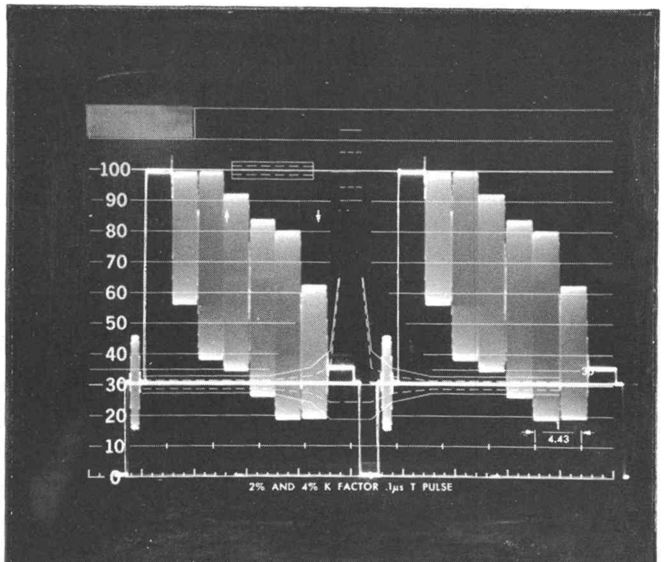
8. Change the COLOR BAR AMPL switch from the 75% amplitude position to the 100% amplitude position. Note the change in amplitude of the color bars. Return the AMPL switch to the up position.

9. Change the WHITE REF switch to the 75% position and note that the white reference bar moves to the 75% white position without changing the amplitude of the color bars. Return the WHITE REF switch to the up position.

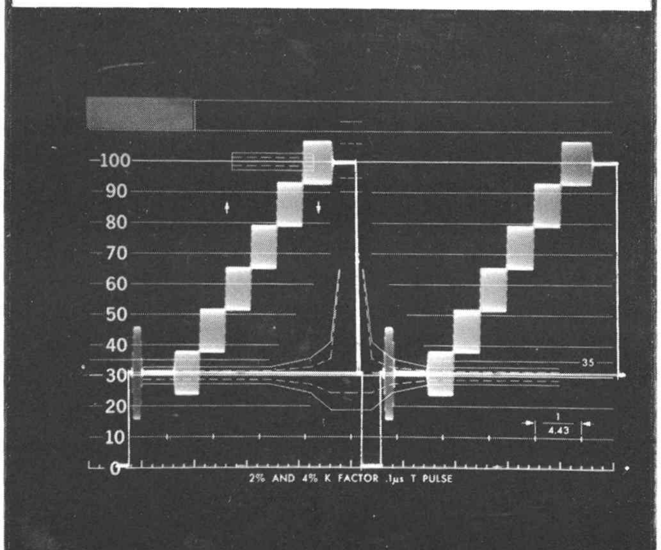
NOTE

The WHITE REF switch is effective only when the AMPL switch is set to the 75% position (up). When the AMPL switch is set to 100%, the white reference level is fixed at 100%.

10. Change the COLOR BAR U and V switches to the center (SPLIT FIELD) position and the RM529 Horizontal Display switch to the 2 Field position. Note that each field is split to include a standard color bar signal for the first 181 lines (approximate) and a color bar luminance signal for the last 60 lines. (See Fig. 2-2A.)



(A) Standard color bar test signal. 75% amplitude, 100% white level.



(B) Standard staircase test signal.

Fig. 2-7. Test signals available at TEST SIGNAL output connector.

Change the Magnifier switch on the RM529 to X25 and set the Horizontal Position control so that full color bars are displayed on the left half of the graticule and color bar luminance levels are displayed on the right half. Note the transition from a full color bar to a luminance signal. (See Fig. 2-2B.)

Return the Type 142 COLOR BAR U and V switches to the up position, the RM529 Magnifier switch to X1, and the Horizontal Display switch to 2 Line. Set the Horizontal Position control to center the display.

11. Change the Type 142 FULL FIELD switch to the center (OFF) position. The display should consist of sync pulses and burst signals.

Change the FULL FIELD switch to the down position. The display should consist of two lines containing a modulated staircase signal. (See Fig. 2-7B.)

12. Change the MOD STAIRCASE U SUBCARRIER switch to the down position. Notice that the modulation on each of the steps has been removed, leaving only a luminance level for each step. Return the U SUBCARRIER switch to the up position.

13. Change the MOD STAIRCASE STEPS switch to the down position. This removes the luminance steps, leaving only the modulation. The modulation may also be removed with the U SUBCARRIER switch.

14. Change the Type 142 MOD STAIRCASE controls as follows:

U SUBCARRIER	Down
STEPS	Down
V SUBCARRIER	UNMOD
APL%	0-10

Note that the display contains sync, burst, and an APL level modulated with a 30 mV V SUBCARRIER sine wave. The APL% switch will select the luminance level of the APL component.

15. Change the V SUBCARRIER switch to the MOD position. This applies three amplitudes of V SUBCARRIER modulation to the APL component. The first amplitude is 30 mV, the second is 300 mV and the third is 600 mV, followed by a portion which is again 30 mV. The APL% level may be changed from 0 to 100% of the peak-to-peak video range (700 mV).

16. Change the RM529 Horizontal controls as follows:

Display	2 Field
Magnifier	X25

Change the Type 142 STEPS switch to the up position and note that a staircase signal now appears on one out of every five lines in the active video region. The modulated APL signal appears on the remaining four out of five lines. Modulation can be applied to the staircase steps with the U SUBCARRIER switch. See Fig. 2-8. Return the MOD STAIRCASE switches to the NORMAL TEST SIGNAL position (up) and the APL% rotary switch to the 0-50 position.

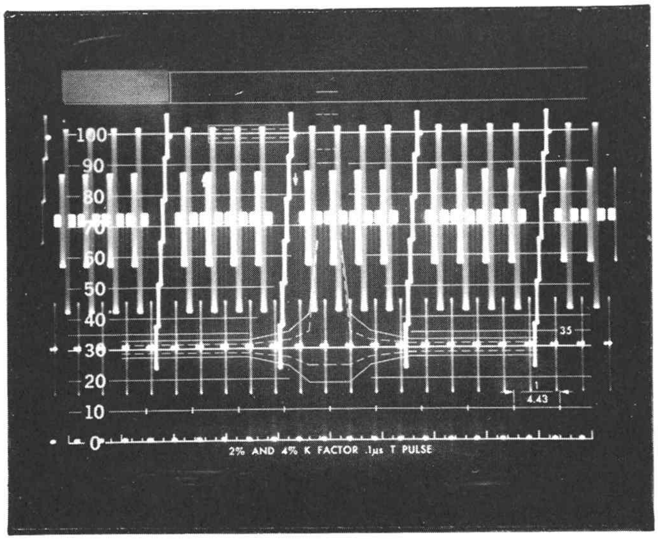


Fig. 2-8. Modulated APL lines with modulated staircase signal every fifth line.

17. Change the Magnifier switch on the RM529 to X20 and position the display with the Horizontal Position control so that the field blanking interval is centered on the screen. Change the Type 142 FULL FIELD switch to the up position and the VITS FIELD switch to the 2 and 4 (down) position. Note the VITS staircase signal appearing during the vertical blanking interval. (See Fig. 2-9.)

When the Type 142 VITS FIELD switch is set to 2 and 4, the Type RM529 Field switch must be set to One to view the VITS signal, since the RM529 sweep is triggered during

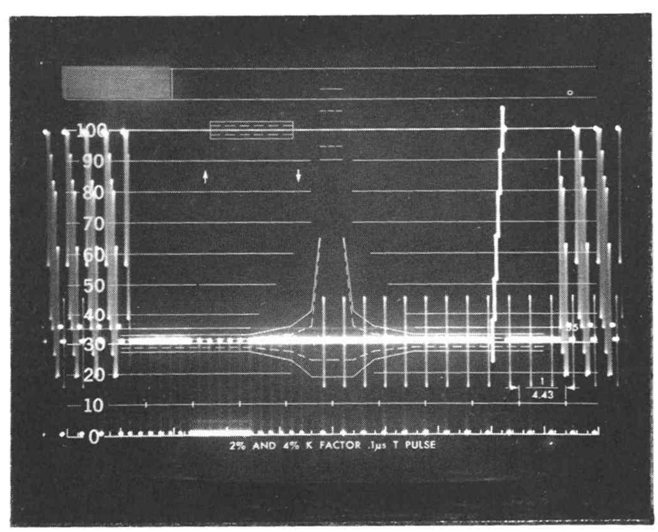


Fig. 2-9. Field blanking interval showing a VITS staircase on line 278.

Ⓐ

field one (or three) and the only full vertical blanking interval appearing under these conditions is for field 2 or 4.

In the Type 142, line 1 starts with the first serrated vertical sync pulse in the vertical blanking intervals which occur after a full line of video. Fields 2 and 4 start during vertical blanking intervals which occur after fields which end in one-half line of video. Refer to Fig. 2-10 for field and line identification.

18. With the controls set the same as in Step 17, set the PAL Frame Selector switch on the Type RM529 to the up position. Note that two bursts are blanked. Now set the PAL Frame Selector switch to the down position and note that a different pair of burst signals is blanked. Fig. 2-10 identifies each of the four fields by showing which pair of burst signals is blanked and whether the vertical blanking interval follows a field which ends in a full or half line of video.

19. Change the Type RM529 Display switch to 1 Line (Line Selector), the Line Selector switch to 18, the Field switch to Two, and the PAL Frame Selector to Norm (center). Change the Type 142 VITS FIELD switch to BOTH and the LINES switch to 15/278. One line containing the VITS staircase signal should be displayed. Turn the Type RM529 Line Selector switch to each side of 18 (17, then 19) and then back to 18. Note that the staircase signal is present only with the Line Selector set to 18. The VITS line location may be changed with the VITS LINES switch on the Type 142.

NOTE

When the Type RM529 Mod 188D is used to display video signals from a 525/60 system, line counting follows the NTSC system. Line 10 is the first line after the last equalizing pulse.

The Type 142 line counting corresponds to the PAL system, in which line 6 is the first line after the last equalizing pulse. Also, the NTSC system uses 6 equalizing pulses, while the PAL system uses 5.

As a result of these differences, the Line Selector numbering on the Type RM529 Mod 188D does not agree with the VITS LINES selector numbering on the Type 142.

To view a given VITS line from the Type 142, the Type RM529 Mod 188D Line Selector switch must be set 3 lines later than that indicated by the Type 142 VITS LINES selector. For example, with the Type 142 VITS LINES selector set to 15/278, the Type RM529 Mod 188D Line Selector must be set to 18.

Procedure 2

A Type 522 PAL Vectorscope is used as a display device in the following steps. The vectorscope provides a means of displaying phase characteristics as well as amplitude information, permitting graphic analysis of hue and saturation in the composite video signal.

R, G, B, Y, U and V components can also be conveniently displayed on the line sweep graticule of the Type 522 PAL. See the Type 522 PAL instruction manual operating instructions for measurement details.

Differential phase and differential gain measurements can be made using the Modulated Staircase test signal. The procedure for making these measurements is detailed in the Type 522 PAL instruction manual.

1. Connect the TEST SIGNAL output on the Type 142 to the Ch A input on the Type 522 PAL through a 75 Ω coaxial cable. If the other Ch A input is not used, connect a 75 Ω terminating resistor to the unused connector.

2. Set the Type 142 controls as indicated in Step 3 of Procedure 1.

3. Set the Type 522 PAL controls as follows:

TYPE 522 PAL

Signal Selector	Full Field, AΦ, Ch A
Ch A 100%-75%-Max Gain	75%
Ch A Gain	Cal
A Phase	As is
Ch B 100%-75%-Max Gain	75%
Ch B Gain	Cal
B Phase	As is
Φ Ref	Burst
Function Selector	Vector PAL
Luminance Gain	Cal
Display	Both
Calibrated Phase	0°
Field	1
Sync	Int

4. The display should be a vector presentation of the chrominance portion of the color bar test signal.

5. Adjust the A Phase control on the Type 522 PAL to align the burst vectors with their respective 135° and 225° positions. (See Fig. 2-11.)

6. Change the COLOR BAR V lever switch on the Type 142 to the down (OFF) position. The display should be a

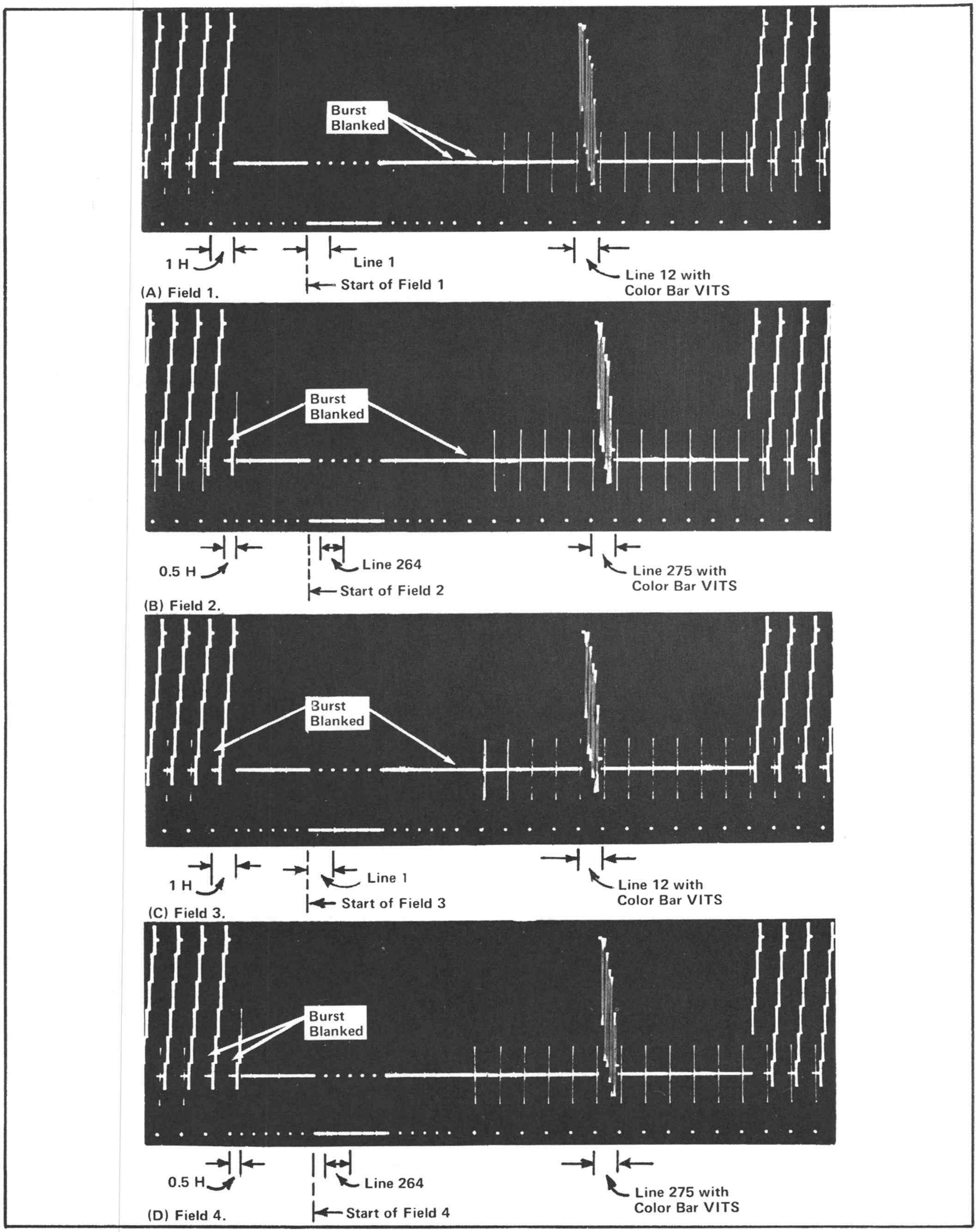


Fig. 2-10. Illustrations showing the field blanking interval details. Use this illustration to identify the field number, line number, and Bruch sequence. (For Bruch sequence the Type 142 SYNCHRONIZATION BURST BLANKING switch is set to BRUCH SEQ and burst is blanked at the points indicated on the waveforms. If the switch is set to NTSC SEQ, burst will be present at these same points.)

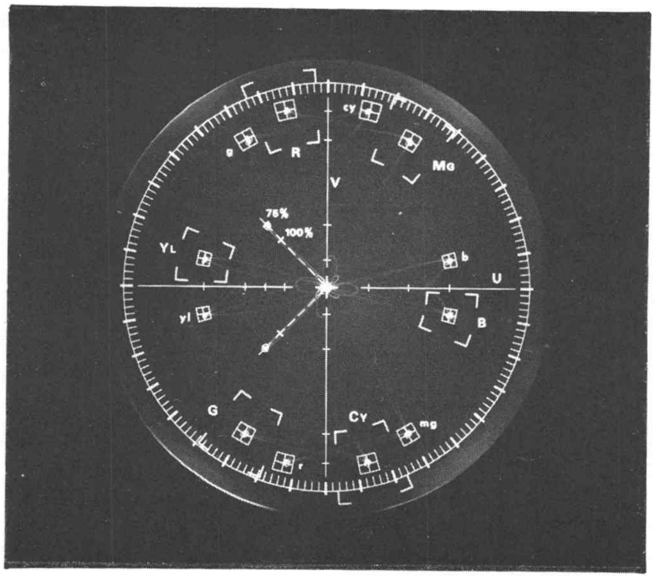


Fig. 2-11. Vector presentation of the color bar test signal. Position of the dots within the smaller boxes indicates that the displayed color vectors are within ±3° phase and ±5% amplitude limits.

horizontal row of 6 dots (excluding the center dot) plus the 135° and 225° burst vectors. This display contains only the U component of the color bar and is useful for setting up U amplitudes of the color segments. Inscribed scale markings on the graticule facilitate the check. (See Fig. 2-12A.)

Return the V lever switch to the up position.

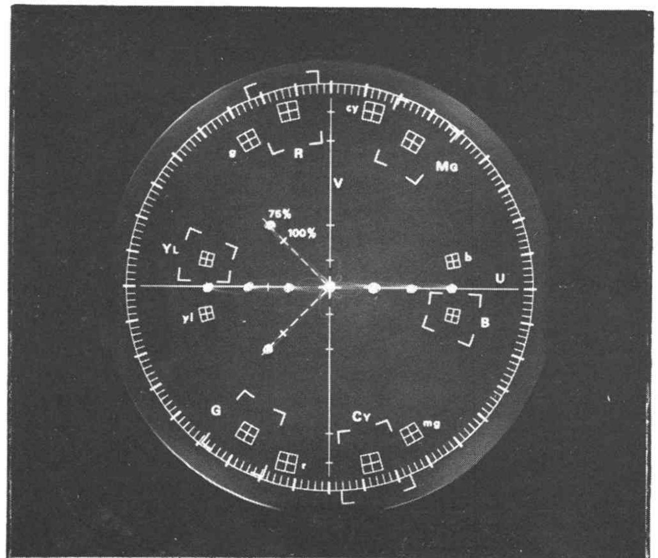
7. Change the COLOR BAR U lever switch on the Type 142 to the down (OFF) position.

The display should now be a vertical row of 6 dots plus the 135° and 225° burst vectors. This display contains only the V component of the color bar and is useful for setting up the V amplitude of the color segments. Inscribed scale markings on the graticule facilitate the check. (See Fig. 2-12B.)

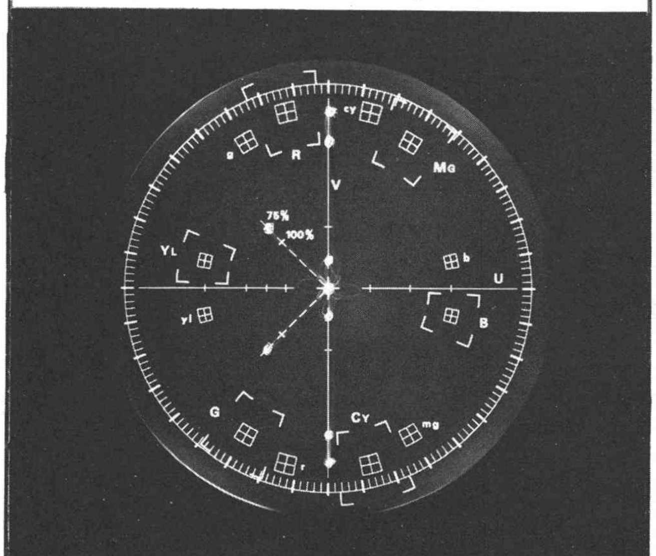
Return the U lever switch to the up position.

8. In the previous two steps, if the V and U amplitudes (dots) fell on or very near their corresponding scale markings, then all color vectors should fall within their respective inner boxes on the graticule (indicating that they are within ±3° phase and ±5% amplitude error limits) when both V and U components are present in the color bar test signal. (See Fig. 2-11.)

9. Change the Type 142 SYNCHRONIZATION V AXIS PHASING lever switch to the center (90°) position. Using



(A) U component of the color bar test signal.



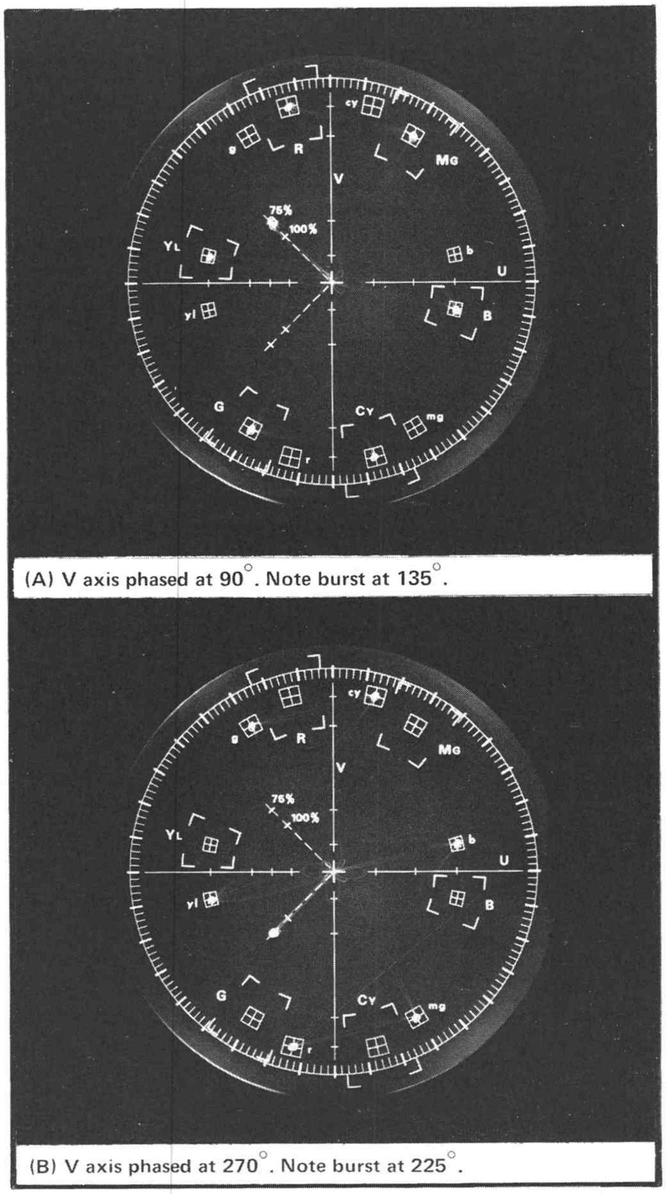
(B) V component of the color bar test signal.

Fig. 2-12. Vector display of the color bar test signal containing only the V or U components.

the Ch A Phase control on the Type 522 PAL, line up the burst vector with the 135° vector line on the graticule. Note that the display contains only the primary and complementary color vectors. (See Fig. 2-13A.)

10. Change the V AXIS PHASING lever switch to the down (270°) position. Using the Ch A Phase control, line up the burst vector with the 225° vector line. Note that the display includes only the conjugate color vectors. (See Fig. 2-13B.)

Return the V AXIS PHASING switch to the up (90°/270°) position, and set the 135° and 225° burst vectors on their respective vector lines on the graticule.



(A) V axis phased at 90°. Note burst at 135°.

(B) V axis phased at 270°. Note burst at 225°.

Fig. 2-13. Vector display of the color bar test signal with the V axis phased at 90° (A), and 270° (B).

11. Change the Type 142 FULL FIELD switch to the down (MOD STAIRCASE) position and the V SUBCARRIER switch to the down (MOD) position. Set the APL% control to the 0-10 position.

The display should consist of a vertical row of 6 dots (excluding the center dot), the 135° and 225° burst vectors, and the U subcarrier vector at 0°. This display illustrates the U subcarrier chrominance on the staircase and the 30 mV, 300 mV, and 600 mV V subcarrier modulation levels on the APL lines, with the V subcarrier phase alternating between 90° and 270°. (See Fig. 2-14.)

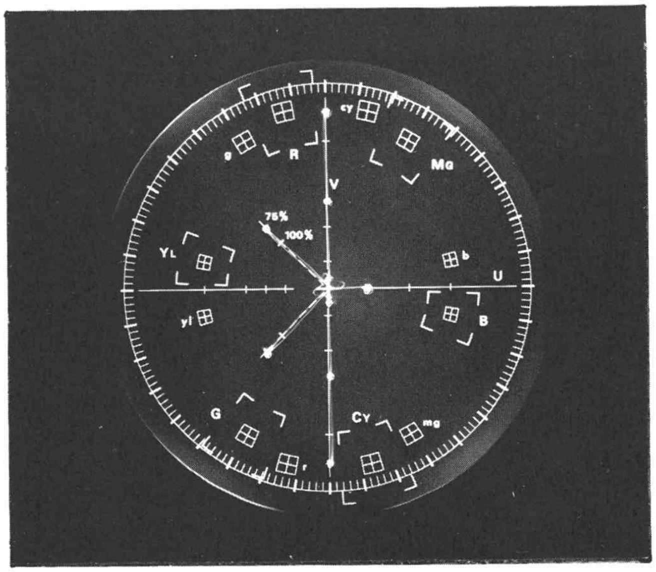


Fig. 2-14. Vector display of the staircase test signal modulated with the U subcarrier (0°) and APL lines modulated with 3 levels of the V subcarrier (90° and 270°).

12. Connect a 75 Ω cable between the SUBCARRIER output of the Type 142 and one of the Ext CW Φ Ref inputs on the Type 522 PAL. Connect a 75 Ω termination to the other Ext CW Φ Ref input.

Change the Φ Ref switch on the Type 522 PAL to the Ext position. Change the Type 142 FULL FIELD switch to the up (COLOR BAR) position.

Now, either the Ch A Phase control on the Type 522 PAL or the SYNCHRONIZATION SUBCARRIER PHASE control on the Type 142 may be used to adjust the phase of the vector dispaly on the Type 522 PAL.

Selecting PAL PULSE Output Characteristics

The PAL PULSE output signal may be selected to start with the leading edge of the line sync pulse on lines with either 135° or 225° burst phasing. Phasing of the PAL PULSE is independent of the front-panel V AXIS PHASING switch.

To start the PAL PULSE output signal coincident with lines at 135° phase, pin 5 of U1223 is connected through R1223 to C1223 and thence to pin connector AL. Pin 7 of U1223 is connected through R1222 to the Bruch Logic stage. Also, pin 7 of U1223 is connected through C1226 to pin 6 of U1211 (Int PAL Pulse Gate). Unless ordered otherwise, the instrument will be factory-wired in this manner.

To start the PAL PULSE signal coincident with lines at 225° phase, the connections from pins 5 and 7 of U1223 to R1222 and R1223 are reversed. This is accomplished by physically rotating the positions of R1222 and R1223 by 90°. The resistors are so placed that the connections will mechanically fit in either position. (See Fig. 2-15.)

PAL PULSE amplitude may be selected by choosing the value of R981 in the emitter circuit of Q982 (Output Amps board). The instrument is factory-wired with a value of 2 kΩ for R981, giving an output amplitude of 4 V. Increasing R981 to 8 kΩ gives a PAL PULSE amplitude of 1 V. (See Fig. 2-16 for location.)

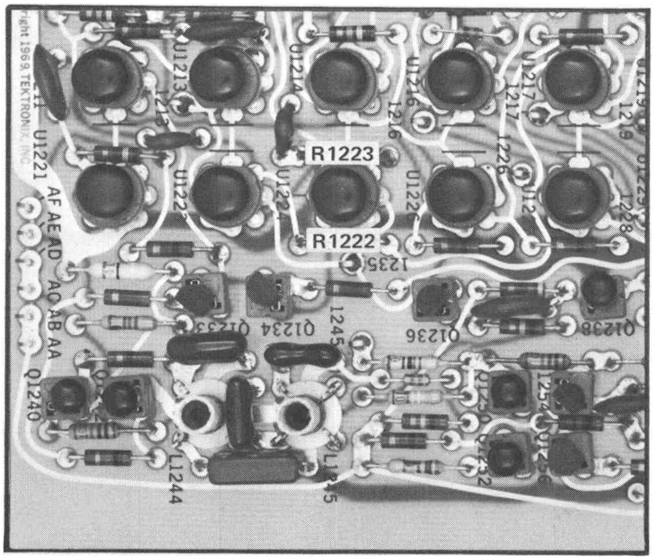


Fig. 2-15. PAL Lock board showing location of PAL PULSE phasing connections, R1222 and R1223.

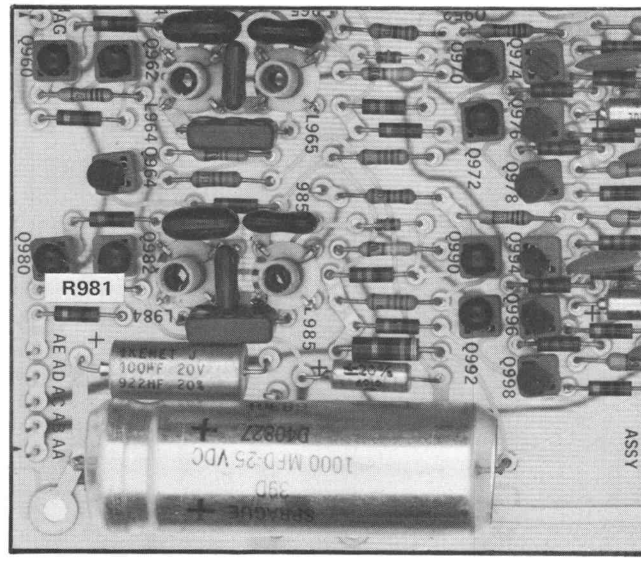


Fig. 2-16. Output Amps board showing location of PAL PULSE amplitude selection, R981.

NOTES

GLOSSARY OF TERMS

ACTIVE VIDEO LINES: All video lines not occurring in the vertical blanking interval.

APL: Average picture level. The average luminance level of the unblanked portion of a television line, measured in per cent of white level.

BACK PORCH: That portion of the composite video signal which lies between the trailing edge of the horizontal sync pulse and the trailing edge of the horizontal blanking pulse.

BLANKING LEVEL: The level of the front and back porches of the composite video signal.

BREEZEWAY: The portion of the back porch between the trailing edge of the sync pulse and the start of the color burst.

BURST FLAG: Pulses used to key out a portion of the 3.575611 MHz sine wave subcarrier for use as a reference for the color signal.

CHROMINANCE: That property of light which produces a sensation of color in the human eye apart from any variation in luminance that may be present.

COLOR BAR: A test signal, typically containing six basic colors: yellow, cyan, green, magenta, red and blue, which is used to check the chrominance functions of color TV systems.

COLOR BURST: This normally refers to a burst of approximately 10 cycles of 3.575611 MHz subcarrier frequency on the back porch of the composite video signal. This serves as a color synchronizing signal to establish a frequency and phase reference for the chrominance signal.

COLOR SUBCARRIER: In color systems, this is the carrier signal whose modulation sidebands are added to the monochrome signals to convey color information.

COMPOSITE BLANKING: This signal is composed of pulses at line and field rates, used to blank the return traces on a picture tube.

COMPOSITE SYNC: Line and field rate synchronizing pulses (including field equalizing pulses) are combined to form the composite sync signals.

COMPOSITE VIDEO: For color systems, this consists of blanking, line and field synchronizing pulses, color synchronizing signals, chrominance and luminance picture information. These are all combined to form the complete color video signal.

CONVERGENCE: In color television, the meeting or crossing of the three electron beams at the shadow mask.

CROSSHATCH: A grid of vertical and horizontal white bars, normally displayed on a picture monitor or television receiver.

DIFFERENTIAL GAIN: The change in amplitude of the color subcarrier, introduced by a stage or system, measured in dB or per cent, as the luminance on which it rides is varied from blanking to white level.

DIFFERENTIAL PHASE: The phase change of the color subcarrier introduced by a stage or system, measured in degrees, as the luminance level on which it rides is varied from blanking to white level.

EBU: European Broadcast Union.

EIA: Electronic Industries Association.

EQUALIZING PULSES: Pulses of one-half the width of the horizontal sync pulses which are transmitted at twice the rate of the horizontal sync pulses during the portions of the vertical blanking interval immediately preceding and following the vertical sync pulses. The purpose of these pulses is to cause the vertical deflection to start at the same time in each interval. The pulses also serve to keep the horizontal sweep circuits in step during the portions of the vertical blanking interval immediately preceding and following the vertical sync pulse.

FIELD: In PAL systems, four fields complete one cycle. The color burst keyout is different for each field, so that the phase of the subcarrier derived from the burst signal is switched 180° from one line to the next. This system helps to minimize hue errors which may occur in a color transmission.

FIELD BLANKING: Refers to the blanking signal which occurs at the end of each field. Also called vertical blanking.

FIELD FREQUENCY: The rate at which one complete field is scanned, normally 59.94 times per second.

FRAME: One complete picture scan consisting of two fields of interlaced scanning lines. In PAL systems, a

complete cycle includes four fields, with one pair of fields laid on top of the previous pair.

FRONT PORCH: That portion of the composite video signal which lies between the leading edge of the horizontal blanking pulse and the leading edge of the corresponding sync pulse.

H RATE: The time for scanning one complete line, including blanking; 1/15734 second or 63.56 μs.

HORIZONTAL DRIVE: A pulse at H-rate used in TV cameras. Its leading edge is coincident with the leading edge of the horizontal sync pulse and the trailing edge is coincident with the leading edge of the burst flag pulse.

HUE: The attribute of color perception that determines whether the color is red, yellow, green, blue, or the like. White, black, and gray are not considered hues.

LINE BLANKING: The blanking signal at the end of each scanning line. Used to blank out the horizontal retrace. Also called horizontal blanking.

LINE FREQUENCY: The number of horizontal scans per second. For 525 line, 60 Hz systems, this is approximately 15,734 scans per second.

LUMINANCE: The amount of light intensity, which is perceived by the eye as brightness (referred to as "Y" in the composite video signal).

NTSC: National Television Systems Committee.

REFERENCE WHITE LEVEL: The level corresponding to the specified maximum excursion of the luminance signal in the white direction.

SATURATION: This indicates how little a color is diluted by white light, distinguishing between vivid and weak shades of the same hue. The less white light in a given hue, the greater is its saturation. Normally expressed as a percentage.

SETUP: The separation in level between blanking and reference black levels.

STAIRCASE: A video test signal containing several steps at increasing luminance levels. The staircase is usually amplitude modulated by the subcarrier frequency and is useful for checking amplitude and phase linearities in video systems.

SYNC: An abbreviation for the words "synchronization," "synchronizing," etc. Applies to the synchronization signals, or timing pulses, which lock the electron beams of the picture monitors in step with the electron beam of the television camera tube. The color sync signal is known as color burst.

U SUBCARRIER: A color signal corresponding to the 0°-180° axis of a vector diagram. It is formed from a combination of red, green, and blue chrominance signals.

V SUBCARRIER: A color signal corresponding to the 90°-270° axis of a vector diagram. It is formed from a combination of red, green, and blue chrominance signals. Any color on the vector diagram can be made from a combination of U and V signals.

VERTICAL BLANKING INTERVAL: The blanking portion which starts at the end of each field. It contains the equalizing pulses, the vertical sync pulses, and VITS (if desired).

VERTICAL DRIVE: A pulse at field rate used in TV cameras. Its leading edge is coincident with the leading edge of the vertical blanking pulse and its duration is 10 1/2 lines.

VITS: Vertical Interval Test Signal. A signal which may be included during the vertical blanking interval to permit on-the-air testing of video circuitry functions and adjustments.

NOTES

SECTION 3
CIRCUIT DESCRIPTION

Change information, if any, affecting this section will be found at the rear of the manual.

Introduction

This section begins with a functional block diagram description. A complete block diagram (except for the Power Supply circuit) of the Type 142 is provided on a pullout page in Section 8.

Since this instrument uses numerous interconnections between stages to generate the composite video waveform, many of these interconnections must also be shown on the overall block diagram. To facilitate tracing the signal from one block to the next, the block diagram description that follows is keyed to the diagrams illustrated in Figs. 3-1 through 3-4. These illustrations divide the overall block diagram into 4 portions as follows:

1. Block diagram showing the stages required for generating the SUBCARRIER, VERT DRIVE, HORIZ DRIVE, COMP SYNC, CONVERGENCE PATTERN, BURST FLAG and COMP BLANKING output signals.

2. Block diagram showing the stages required for generating the MOD STAIRCASE composite video output signal.

3. Block diagram showing the stages required for generating the COLOR BAR composite video output signal.

4. Block diagram showing the stages required for generating the PAL PULSE output signal.

Where possible, all interconnecting lines between stages show the number or type of signals on that line.

GENERATING THE SUBCARRIER, VERT DRIVE, HORIZ DRIVE, COMP SYNC CONVERGENCE PATTERN, BURST FLAG AND COMP BLANKING SIGNALS (See Fig. 3-1)

To produce the above inputs, the block diagram description is broken into 2 portions (1) SUBCARRIER and (2) VERT DRIVE, COMP SYNC, CONVERGENCE PATTERN, BURST FLAG and COMP BLANKING.

The Master Oscillator generates the 3.575611 MHz subcarrier frequency. The 3.575611 MHz signal is then applied to the Oscillator Output stage. This output stage serves two main functions: (1) isolates the oscillator stage and (2) maintains a constant output. From the Oscillator Output, the subcarrier is applied to the Subcarrier and Sync Source Switching circuitry. The switching stage is controlled by a front-panel switch (SYNCHRONIZATION REF) on the Type 142. With the switch in the INT position, the subcarrier generated in the master oscillator is used to drive the Subcarrier Limiter and Phase Lock Sampler. In the EXT position of the switch, the Oscillator Output circuit is disabled and an external 3.575611 MHz subcarrier may be applied to the Type 142 through the rear-panel SUBCARRIER INPUT connector. With external subcarrier applied to the Type 142, the Phase Lock Sampler circuitry is no longer referenced to the subcarrier and the subcarrier is applied only to the Subcarrier Limiter. Whenever an external subcarrier is used, an external composite sync may also be used. This signal is applied through the Type 142 rear-panel COMP SYNC INPUT connector. The external comp sync signal is integrated and peak detected to produce a field sync peak pulse to drive the Field Preset Gate.

The comp sync is also applied to a ramp generator which produces an H Sync Ramp Signal which drives the Phase Lock Sampler circuitry. External comp sync may also be used without subcarrier, but no chrominance information will be available at the outputs.

The Subcarrier Limiter stage accepts the subcarrier (internal or external) and insures a constant output amplitude of the signal to the Subcarrier Output stage. The Subcarrier Output stage is used as a distribution amplifier.

Other Output Signals

To produce the remaining output signals shown in Fig. 3-1, timing signals must be generated which are referenced to the subcarrier. The Line Frequency Control Oscillator, Line Counter, Line Detail Timing, Phase Lock Sampler, and the DC Control Loop Amplifier perform this function.

The Line Frequency Control Oscillator generates a 1.006993 MHz signal. This frequency is the 64th harmonic of the 15,734 Hz line rate, which is directly related to the subcarrier frequency. The 1.006993 MHz signal is applied to the Line Counter, which divides this frequency as needed

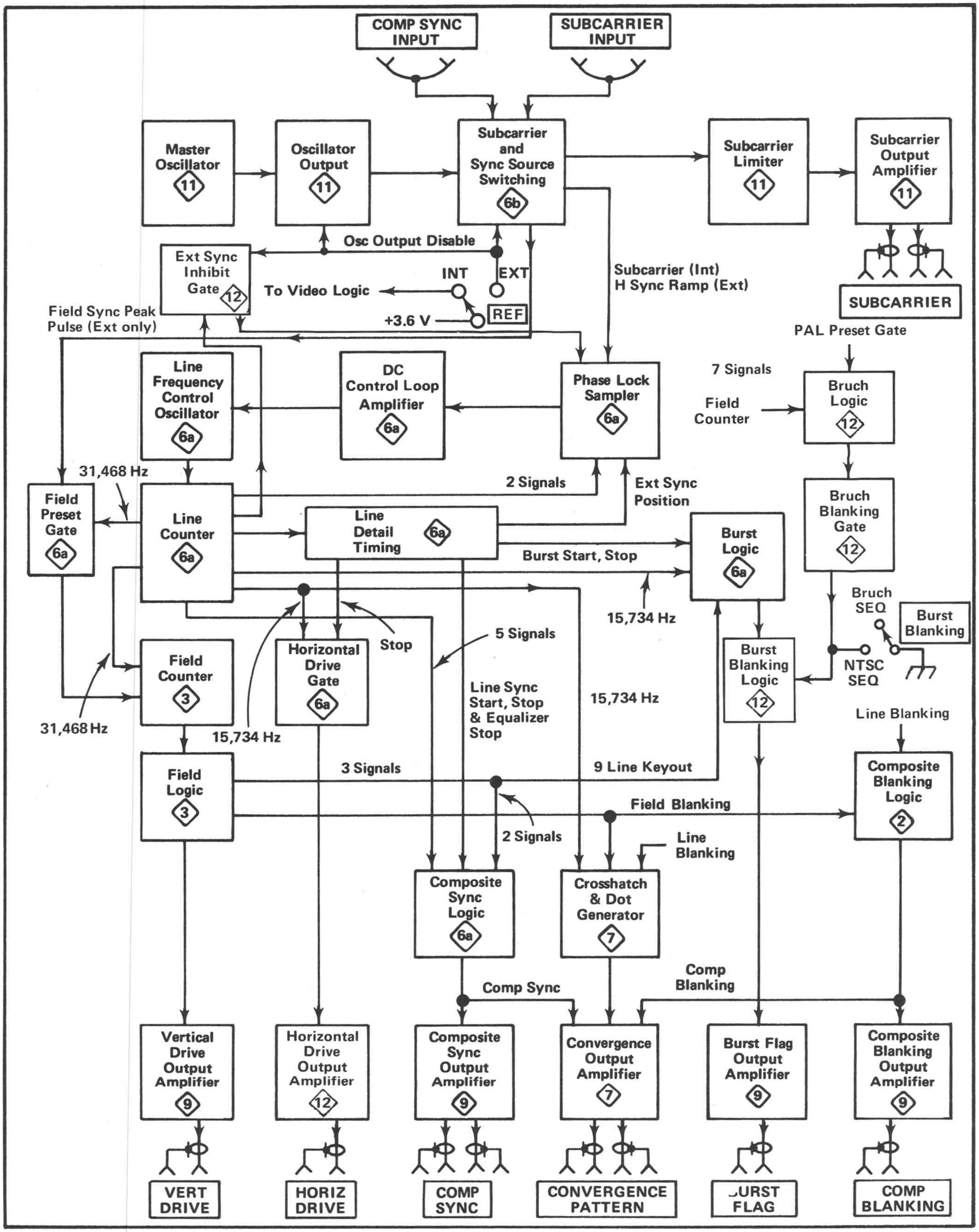


Fig. 3-1. Block diagram showing the stages required for generating the Subcarrier, Vert Drive, Horiz Drive, Comp Sync, Convergence Pattern, Burst Flag and Comp Blanking output signals.

Ⓐ

by a 2, 4, 8, 16, 32, 64, and 128 sequence. After the 32nd division of the 1.006993 MHz signal, a 31468 Hz signal is applied to the Line Detail Timing stage. This circuitry is used to determine the exact point at which the sampling takes place for generating other time-related signals. On the 64th and 128th divisions of the Line Counter, a signal is produced which is also applied to the Phase Lock Sampler. This occurs on every 455th cycle of the subcarrier, which is also applied to the Phase Lock Sampler (only if internal subcarrier is being used). Any time-shift of the Line Counter will be sampled against the subcarrier and a DC correction voltage will be applied to the DC Control Loop Amplifier. the loop amplifier amplifies the DC voltage obtained from the sampler and applies it to the Line Frequency Control Oscillator, which will change frequency and bring the Line Counter back into a lock with the subcarrier. With an external subcarrier applied to the Type 142, the Phase Lock Sampler will have no reference from which to operate and the oscillator will run at a predetermined frequency. With external subcarrier and comp sync applied to the Type 142, the circuits will operate as above (using the internal subcarrier) with the only exception being that an H sync ramp will be sampled in place of the subcarrier.

To provide a signal to the Horizontal Drive Output Amplifier, a pulse from the Line Counter sets the Horizontal Drive Gate flip-flop. A short time later another pulse from the Line Detail Timing stage resets the flip-flop and an output signal is obtained. This output is applied to the Horizontal Drive Output Amplifier.

Another stage driven by the Line Counter is the Field Counter. This circuitry is a 525 state Counter driven by the 31 kHz signal obtained from the Line Counter which provides the various outputs needed. When using external comp sync, the Field Preset Gate circuitry produces an output which presets the Field Counter. From the output of the Field Counter the signal is applied to the Field Logic circuitry. To obtain a signal to the Vertical Drive Output Amplifier, a pulse from the ÷2 field counter sets a vertical gate flip-flop. A short time later another pulse from the field counter resets the flip-flop and an output is obtained. This output is then applied to the Vertical Drive Output Amplifier.

Timing signals from the Line Counter, Line Detail Timing, and Field Logic circuits are combined in the Composite Sync Logic stage to produce the composite sync signal. This signal is then coupled to the Composite Sync Output Amplifier, and thence to the front- and rear-panel output connectors.

The Composite Blanking Logic stage combines the line blanking signal from the Color Bar Setup & Line Blanking stage with the field blanking signal from the Field Logic stage to supply a drive signal to the composite Blanking Output Amplifier. The output signal is coupled to a rear-panel output connector.

The Burst Flag signal may correspond to either the NTSC or Bruch sequence. For NTSC sequence of blanking, the signal from the Burst Logic stage is initiated by the Burst Start signal from the Line Detail Timing circuit and a line frequency signal from the Line Counter. A 9-Line Keyout gate from the Field Logic stage eliminates the burst flag during a portion of the vertical blanking interval. The output signal is concluded by the Burst Stop signal from the Line Detail Timing circuit. The burst flag signal, complete with keyout, is coupled to the Burst Blanking Logic stage. When the BURST BLANKING switch is set to NTSC SEQ, the burst flag signal generated by Burst Logic is coupled through the Burst Blanking Logic stage to the Burst Flag Output Amplifier and then to the BURST FLAG output connector.

To generate Bruch sequence of burst blanking, various timing signals from the Field Counter and the PAL Preset Gate are combined in the Bruch Logic stage. The resulting signal is then coupled through the Bruch Blanking Gate to the Burst Blanking Logic stage. This gate blanks the burst flag signals from the Burst Logic stage for a period during the vertical blanking interval as required to provide Bruch sequence of burst.

The Vertical Drive, Horizontal Drive, Composite Sync, Burst Flag and Composite Blanking Output Amplifiers amplify their respective input pulses which are then available at the front and rear panel VERT DRIVE, HORIZ DRIVE, COMP SYNC, BURST FLAG, and COMP BLANKING output connectors.

Line blanking, field blanking and a 15734 Hz signal from the Line Counter drive the Crosshatch and Dot Generator stage. This output is then applied to the Convergence Output Amplifier, where the composite sync and composite blanking signals are added to the signal. This signal is then amplified and available at the front and rear panel CONVERGENCE PATTERN output connectors.

GENERATING THE MODULATED STAIRCASE VIDEO OUTPUT SIGNAL (See Fig. 3-2)

Chrominance

To produce the chrominance portion of the modulated staircase, it is necessary that subcarrier be present to enable the Chrominance Output Amplifier. (See block diagram description for generating composite video, Fig. 3-3.)

Field and line timing signals are applied to the Video Logic stage which produces (1) staircase field drive and (2)

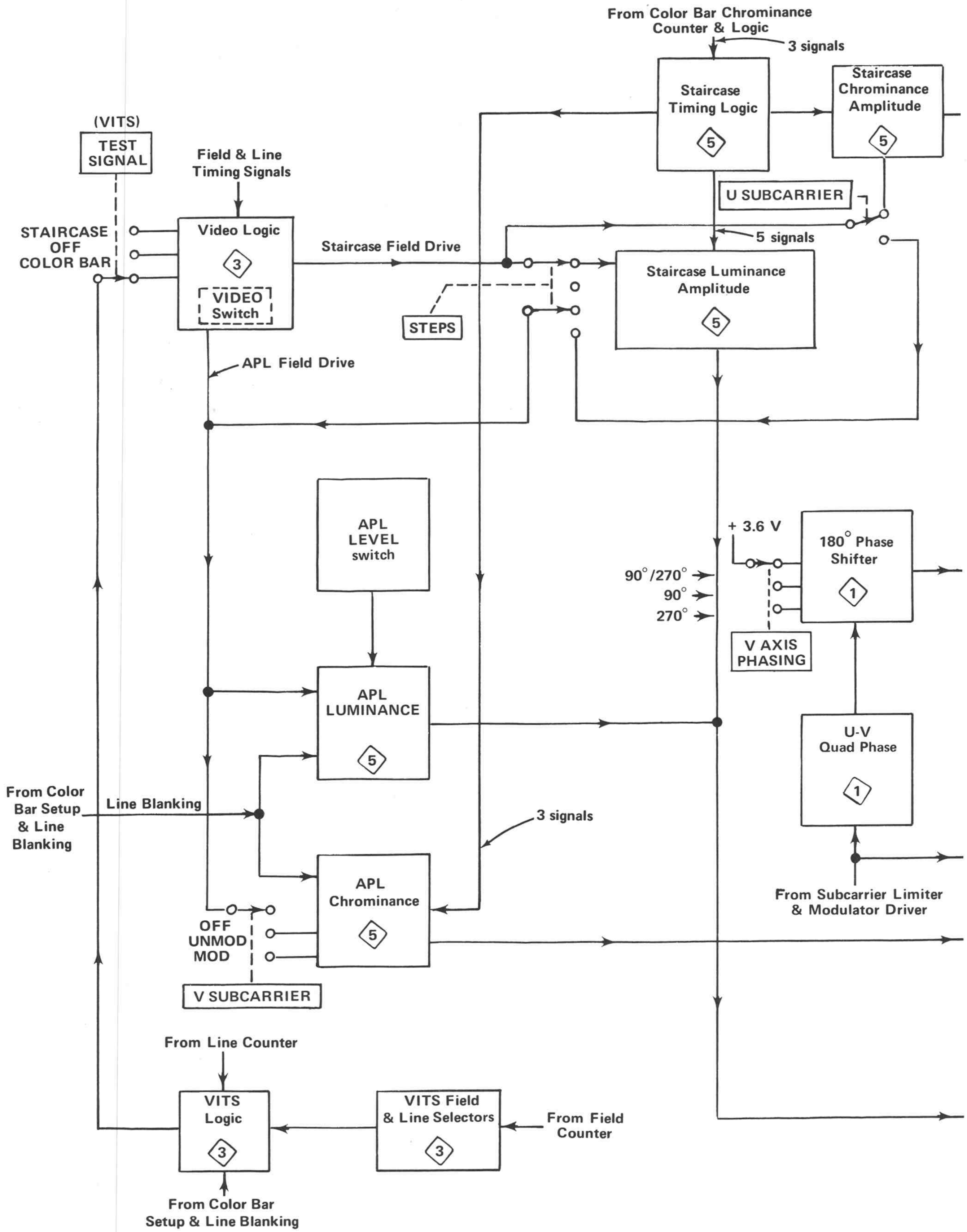


Fig. 3-2. Block diagram showing stages required for generating the Modulated Staircase composite video output signal.

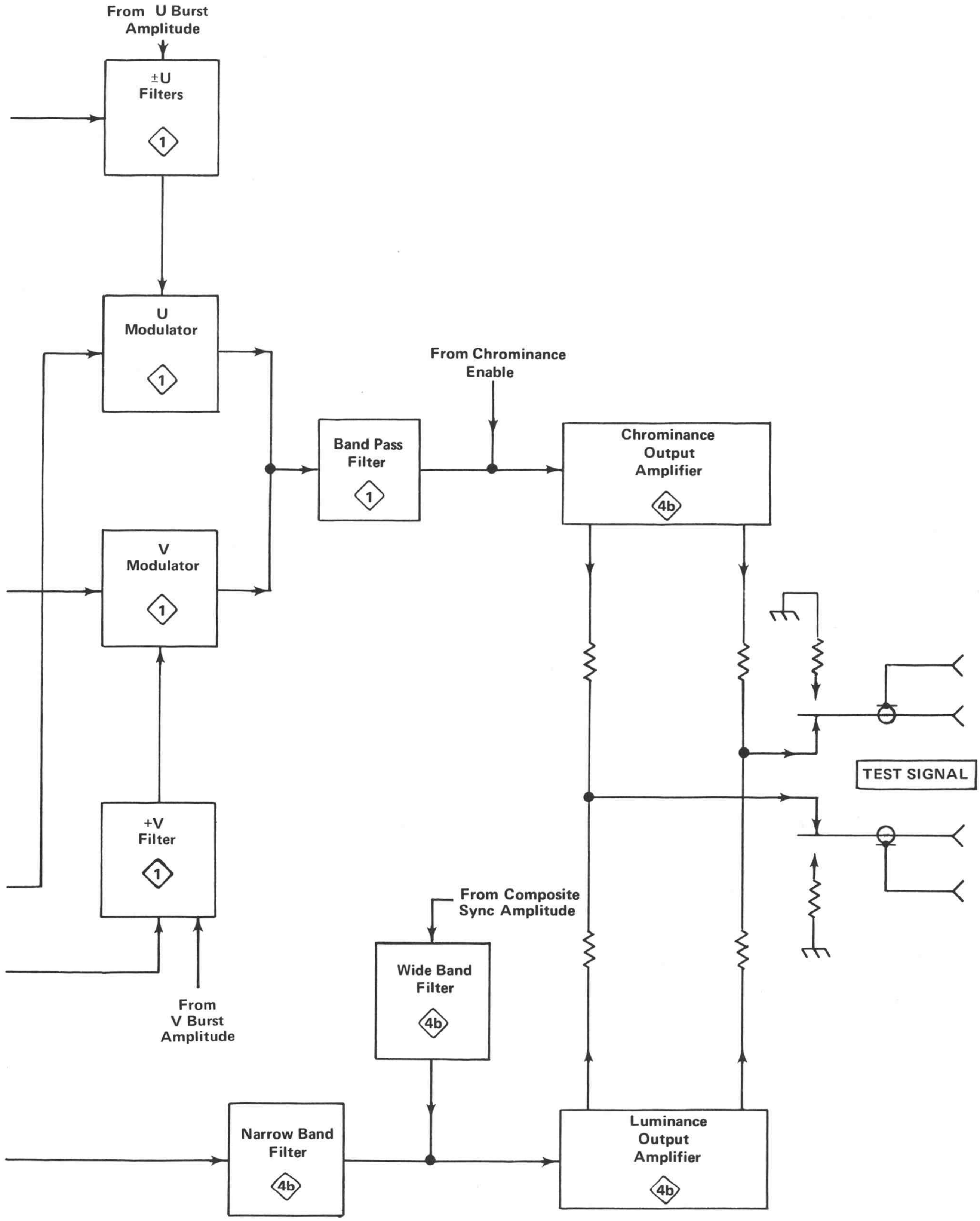


Fig. 3-2. Block diagram showing stages required for generating the Modulated Staircase composite video output signal.

APL field drive. The staircase field drive signal is applied via the U SUBCARRIER switch to the Staircase Chrominance Amplitude stage. Another gate from the Staircase Timing Logic stage is also applied to the Staircase Chrominance Amplitude stage. The combination of these 2 signals produces an output signal which is then applied to the +U Filter. A burst signal from the U Burst Amplitude stage is applied to the +U Filter. The U Filter limits the frequency response of each input signal to about 2 MHz so that the output drive signals to the U Double Balanced Modulator have the same frequency response. Subcarrier is also driving the modulator, so a modulated output is obtained. This output is then applied to the Band Pass Filter. The filter has a center frequency response of 3.58 MHz to pass only the chrominance signal. This chrominance signal is then applied to the Chrominance Output Amplifier for amplification, and is available at the TEST SIGNAL output connectors.

If the U SUBCARRIER and STEPS switches are set in the down (off) position and the V SUBCARRIER switch is set to UNMOD or MOD, the staircase field drive signal is disconnected from the Staircase Chrominance Amplitude stage (disabled by the U SUBCARRIER switch) and applied to the APL Chrominance stage via the above-mentioned switches. APL field drive from the Video Logic stage, 3 signals from the Staircase Timing Logic stage, and line blanking are also applied to the APL Chrominance stage. These 6 signals are combined within the stage and an APL chrominance output signal is obtained. This chrominance signal is then applied to the + V Filter. The output from the filter is applied to the + V Modulator. Subcarrier also drives the V Modulator via the 180° Phase Switcher and U-V Quad Phase stages. Note that burst and subcarrier are also driving the U modulator. The U and V Modulators are Double Balanced, and generate an output with burst displaced from the chrominance by 90°. This signal is then applied to the Band Pass Filter and Chrominance Output Amplifier as described earlier.

Luminance

To produce the luminance portion of the staircase signal (with switches set as shown in Fig. 3-2), signals from the Staircase Timing Logic and the Video Logic stage are combined in the Staircase Luminance Amplitude stage. The output is then applied to the Narrow Band Filter. Another drive to the Narrow Band Filter is the output from the APL Luminance stage. (This stage is controlled by the setting of the APL% switch and the APL field drive from the Video Logic stage.) The APL luminance and staircase luminance signals are then combined in the Narrow Band Filter. The filter also is used to minimize any harmonic frequencies that may adversely affect the chrominance in the output. The filter output is then applied to the Luminance Output Amplifier. Composite sync via the Wide Band Filter (see block diagram description for generating the composite video signal) is also applied to the output amplifier. These two signals are combined and amplified by the Luminance Output Amplifier. The output of the Luminance Output Amplifier is then available at the TEST SIGNAL output connectors.

Note that separate output amplifiers are used: one for chrominance (Chrominance Output Amplifier) and one for luminance (Luminance Output Amplifier). Separate amplifiers minimize Differential Phase and Gain (see Glossary of Terms, Section 2).

GENERATING THE COLOR BAR COMPOSITE VIDEO OUTPUT SIGNAL (See Fig. 3-3)

To produce the above output this block diagram description has been broken into two parts (1) Chrominance and (2) Luminance.

Color Bar Chrominance

If any input signal to the Chrominance Output Amplifier is desired, subcarrier must be present. Without subcarrier, the Chrominance Enable circuit effectively shorts the input of the amplifier to ground.

Assume that the Bar Oscillator is on and the last color bar (blue) is being generated. At the end of blue, the output drops to black or blanking. At this time, a stop signal is generated within the Color Bar Chrominance Counter & Logic stage. This output is applied to the Bar Oscillator Start & Stop Control stage, which disables the Bar Oscillator and color bars cease.

Various timing signals are applied to the Bar Oscillator Start & Bar Preset stage. At a predetermined time during the line blanking interval, a preset pulse is developed by the Bar Oscillator Start circuitry which presets the ÷4 Counter, Color Bar Chrominance Counter & Logic, and the Color Bar Luminance Counter & Logic stages. This preset serves to insure that the chrominance and luminance counters are synchronous. The preset pulse also triggers the 0°-180° Switcher. Just prior (one cycle of bar oscillator) to the position of the white bar, a second pulse is generated within the Bar Oscillator Start & Bar Preset circuitry which is applied to the Bar Oscillator Start-Stop Control stage, enabling the Bar Oscillator. The Bar Oscillator turns on. After one cycle of oscillation, the output triggers the ÷4 Counter, and color bars are again generated at the output.

The output of the Color Bar Chrominance Counter & Logic circuit consists of three gate signals corresponding to the red, green, and blue color signals. These signals are applied to the Color Bar Chrominance Amplitude stage. Also, applied to this stage via the U and V switches are the color bar field drive signals. With the U and V switches in

the up position, the Color Bar Full Field Drive signal gates the chrominance on during all active lines of the field. When the U and/or V switch(es) are in the SPLIT FIELD (center) position, the Color Bar Split Field Drive signal gates on the respective U and/or V component(s) for all except the last 60 lines in each field. Amplitude-setting voltages are also present from the Color Bar & Setup Voltage Supplies stage. The output of the stage is then applied to the U and V Filters. Note that burst is also applied to the U and V Filters via the U and V Burst Amplitude stages. The filters combine their respective inputs and limit the frequency response of these signals, which are then applied to the V and U Modulators.

Subcarrier is applied to the Subcarrier Phase (goniometer) stage which allows the operator to vary the phase of the subcarrier applied to the U Modulator and U-V Quad Phase stages. The quad phase circuitry shifts the phase of the subcarrier by 90° and applies it to the 0°-180° Phase Switcher. The output of this stage is then used to drive the V Modulator. The Modulators, being driven with the above mentioned signals, operate in a Double Balanced condition to produce an output which contains only the required sidebands of chrominance information. This chrominance information is applied to the Band Pass Filter and Chrominance Output Amplifier. (These circuits were discussed in the block diagram description for Fig. 3-2.)

Color Bar Luminance

Referring to Fig. 3-3, the output from the ÷4 Counter is applied to the Luminance Delay stage. This stage introduces a time delay for the luminance portion of the output signal soxthat both chrominance and luminance information is combined properly at the TEST SIGNAL output connectors.

The output of the Color Bar Luminance Counter & Logic stage consists of three gate signals corresponding to the luminance red, green, and blue. These signals are applied to the Color Bar Luminance Amplitude stage. Also driving this stage are the field and line drive signals. Amplitude-setting voltages are also present from the Color Bar & Setup Voltage Supplies stage. The output is then applied to the Wide Band Filter.

The Wide Band Filter is also driven by composite sync via the Composite Sync Amplitude stage. The filter combines both signals and provides color bar luminance amplitude steps that are extended to the allowable bandwidth of the system. This signal is then applied to the luminance Output Amplifier for amplification and use at the TEST SIGNAL output connectors.

GENERATING THE PAL PULSE OUTPUT SIGNAL (See Fig. 3-4)

Generation of the PAL PULSE signal is accomplished by gating various logic stages in such a manner that the PAL PULSE is synchronous with the proper line and field sequence.

The signal can be made synchronous with an externally applied PAL Pulse signal or an external sync signal. If an external PAL Pulse is applied, the input signal is amplified and inverted by the Ext PAL Pulse Drive stage. The resulting positive pulse is coupled to the PAL Preset Gate stage, serving as a preset signal for the gate. When an external sync signal is applied, the Field Preset Gate stage combines a 31 kHz signal from the Line Counter with a vertical sync pulse from the Subcarrier & Sync Source Switching stage to develop the Vertical Preset signal. This signal is coupled through the Buffer stage to the PAL Preset Gate.

The PAL Preset Gate is triggered by the signal from the Field 1,3 Preset Gate, which combines signals from the Field Counter and Field Logic stages to develop the required trigger pulse.

The output of the PAL Preset Gate is coupled to three stages; (a) Int PAL Pulse Gate, (b) Bruch Logic, and (c) 0°-180° Phase Shifter. Connections to Bruch Logic and the 0°-180° Phase Shifter are interchangeable to permit selection of the start of the PAL Pulse signal to coincide with lines containing either 135° or 225° burst phasing.

The Int PAL Pulse Gate is preset by the signal from the PAL Preset Gate and is triggered by the pulse from the Coincidence Gate. Composite Sync and the horizontal drive signal are inputs to the Coincidence Gate. The Int PAL Pulse Logic stage combines the output signal from the Int PAL Pulse Gate with an inverted horizontal drive signal to develop the PAL Pulse signal. This signal is coupled to the PAL Pulse Output Amplifier, where it is amplified, inverted, and coupled to the front- and rear-panel PAL PULSE output connectors.

INTEGRATED CIRCUITS

Many of the functions within the Type 142 are performed through the use of integrated circuits in the form of micrologic units. Complexities of the television composite sync waveform require numerous counting and logic functions for development of the signal. Gating of chrominance and luminance signals and generation of the staircase and

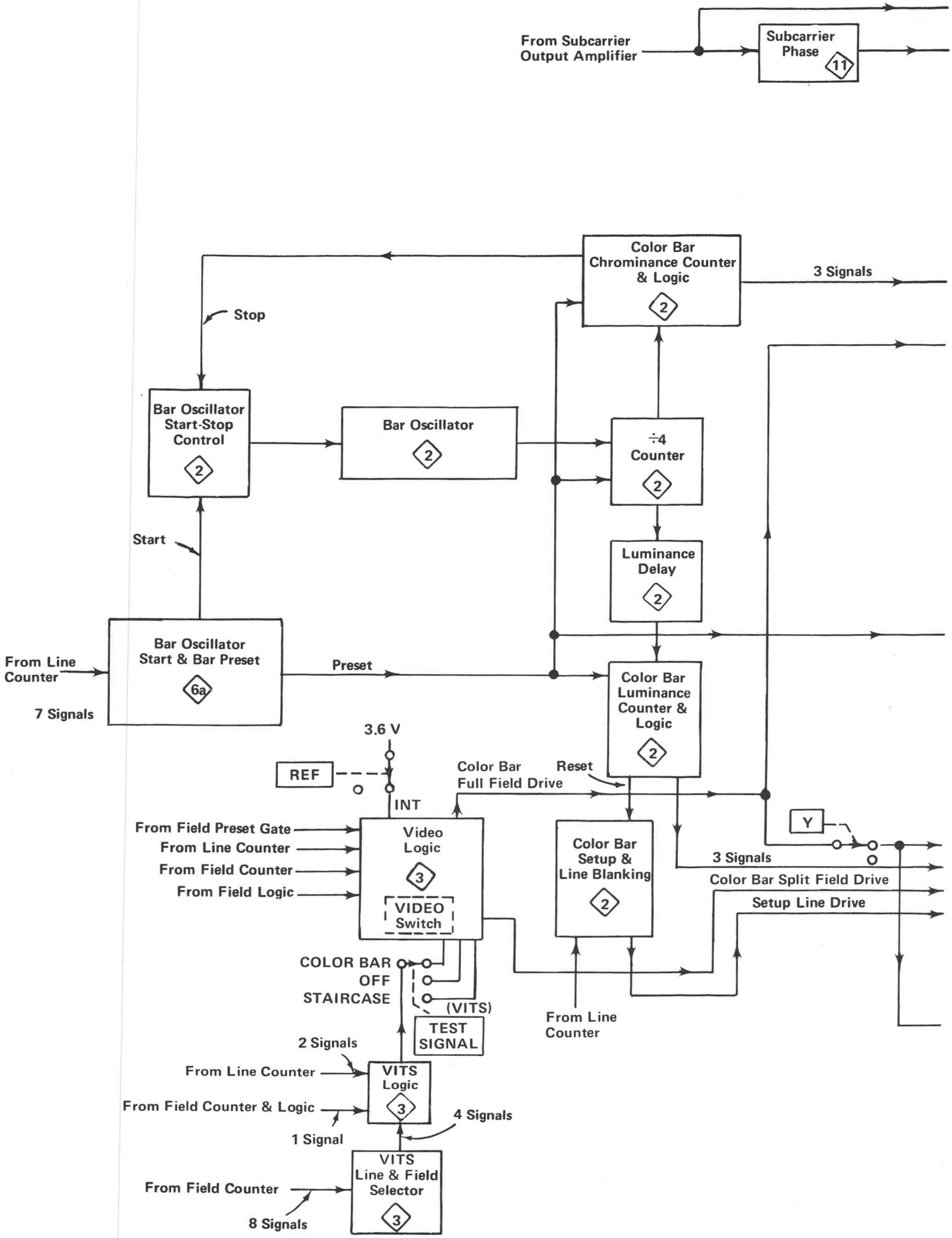


Fig. 3-3. Block diagram showing stages required for generating the Color Bar composite video output signal.

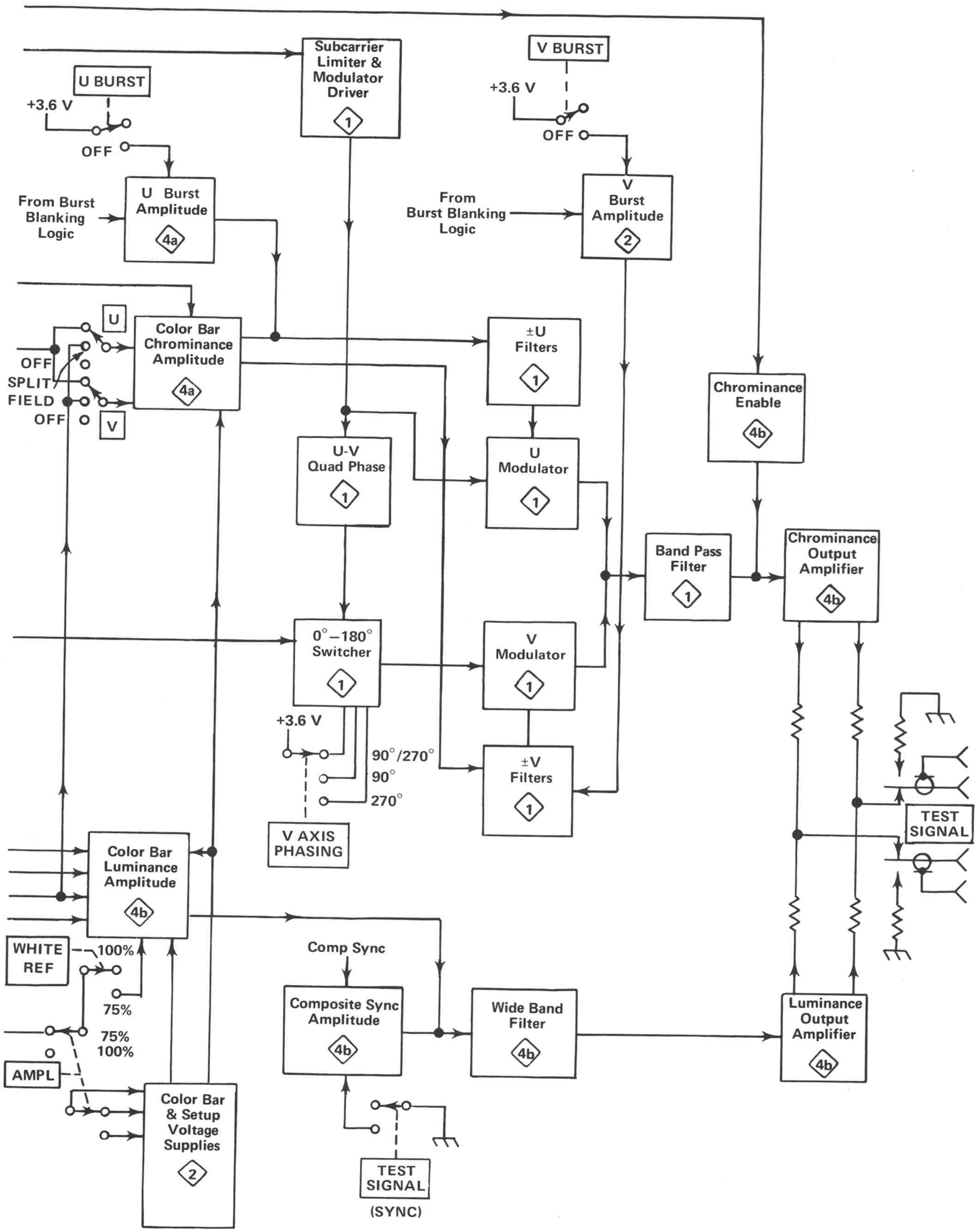


Fig. 3-3. Block diagram showing stages required for generating the Color Bar composite video output signal.

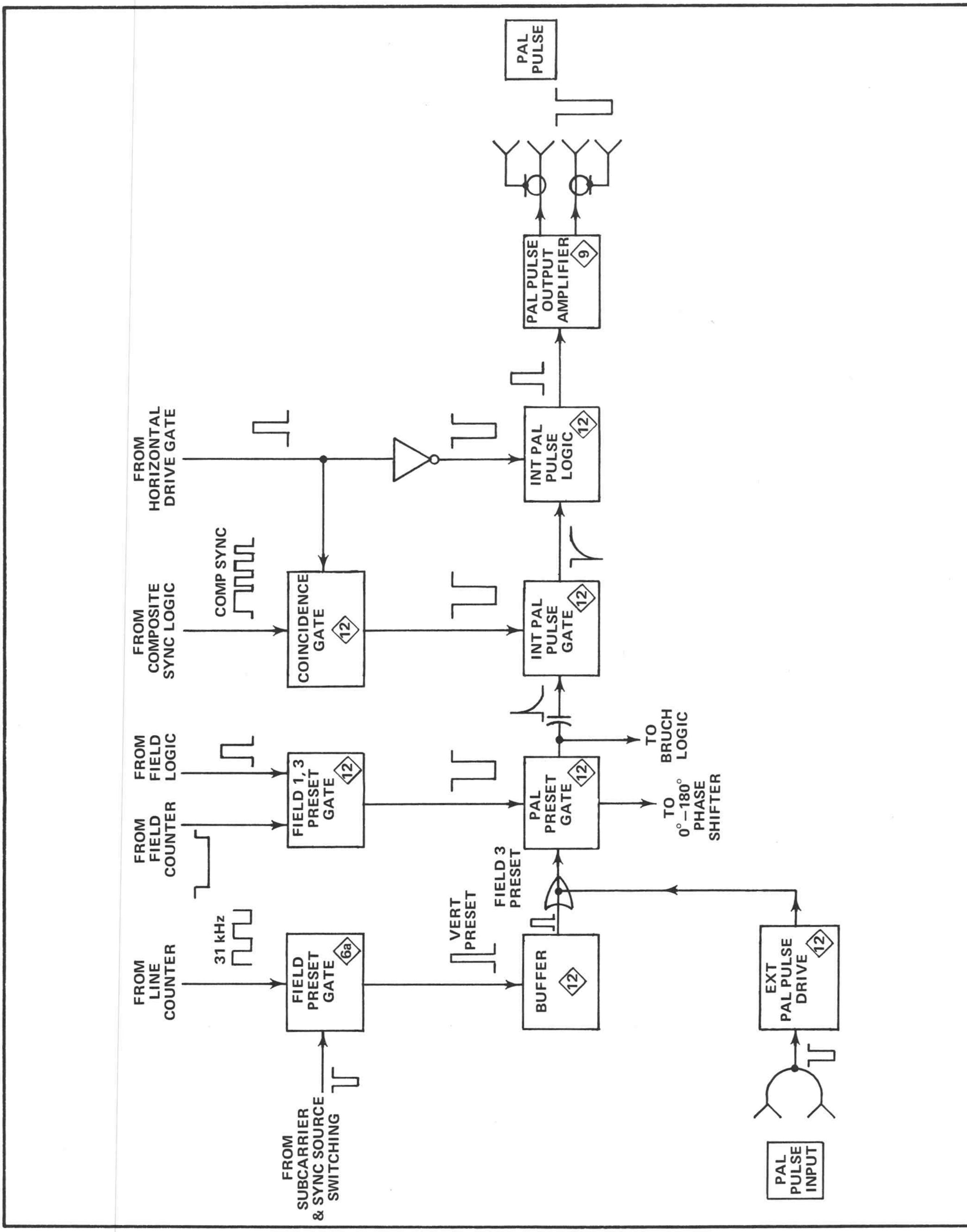


Fig. 3-4. Block diagram showing stages required for generating the PAL Pulse output signal.

color bar luminance signals are also accomplished by means of integrated circuitry.

Knowledge of the internal workings of the various micrologic units is not necessary for an understanding of circuitry in the Type 142, since the circuit description is concerned primarily with signal conditions at the input and output terminals of each unit.

Depending on external connections, several different functions may be performed by a single type of micrologic unit.

Rather than describe each units' operation repeatedly throughout the circuit descriptions, each configuration will be explained here. The information in this portion can serve as reference material when studying the individual circuits.

Figs. 3-5 and 3-7 illustrate the various symbols which are used in this manual to designate micrologic units. A single unit may contain two or more sections which may be used separately. In these cases, one section will be labeled (A) and a section will be labeled (B).

Micrologic Unit Configurations

Type FμL 914 Dual Two-Input Gate.

Several different functional capabilities are indicated in the various connection arrangements for Type FμL 914 in Fig. 3-5.

The basic symbol for this unit is illustrated in Fig. 3-5 (A). The FμL 914 consists of two such units which may be used jointly or as completely separate circuit elements.

Fig. 3-5 (G) shows the symbol used in this manual to indicate that the desired input or output signals are "low". A small circle between the input or output terminal and the connecting lead indicates that the signal causing the desired reaction at that point will be a "low". The absence of a small circle adjoining a connecting lead to a terminal indicates that the desired signal at that point will be a "high".

A "high" indicates a more positive voltage level, while a "low" represents a less positive (or ground) level signal.

In the Type 142 schematics and circuit description, the level-indicating symbols are used in a manner known as POSITIVE LOGIC.

Fig. 3-5 (A) represents an AND gate, in which both inputs (pins 1 and 2) must be low to yield a high at the output (pin 7). Any other combination of inputs results in a low at the output. Table 3-1 is a truth table which shows the various combinations of signal levels for this two-input AND gate.

TABLE 3-1

Truth Table for 2-Input AND Gate

Input		Output
Pin 1	**Pin 2**	**Pin 7**
H	H	L
H	L	L
L	H	L
L	L	H

An OR gate is symbolized in Fig. 3-5 (B). The output of this OR gate will be low when pin 1, pin 2 or both pins 1 and 2 are high.

Fig. 3-5 (C) shows the symbols used for an inverter or buffer amplifier. The symbol with the circle at the input pin indicates that the input signal should be a low and the output will be high. The circle at the output terminal, of course, indicates the opposite. The inverter stages are actually one-half of one of the two-input AND gates in a Type FμL 914. The input is the base of a transistor and the output is the collector. The emitter is grounded.

A four-input AND gate is shown in Fig. 3-5 (D). The output pins of the two AND gates are connected together. All four input pins must be low to achieve a high at the output terminal (pins 6 and 7).

When the output terminals of two or more separate devices or signal sources are connected together, the junction of their connection forms a "phantom" AND or OR gate. This is usually indicated by a small AND or OR symbol around the junction. Fig. 3-5 (E) illustrates a phantom AND symbol. This means that all signals must be present at the junction to develop the desired signal.

A two-input Set-Reset Flip-Flop is symbolized in Fig. 3-5 (F1 and F2). A description of a complete cycle of operation follows:

The Set-Reset Flip-Flop has two stable states. In one state, pin 7 will be high and pin 6 will be low. In the other state, the levels are interchanged. To begin the cycle, assume that at first pins 1 and 2 are low. Pin 7, and therefore pin 3, will be high. With either pin 3 or pin 5 high, pin

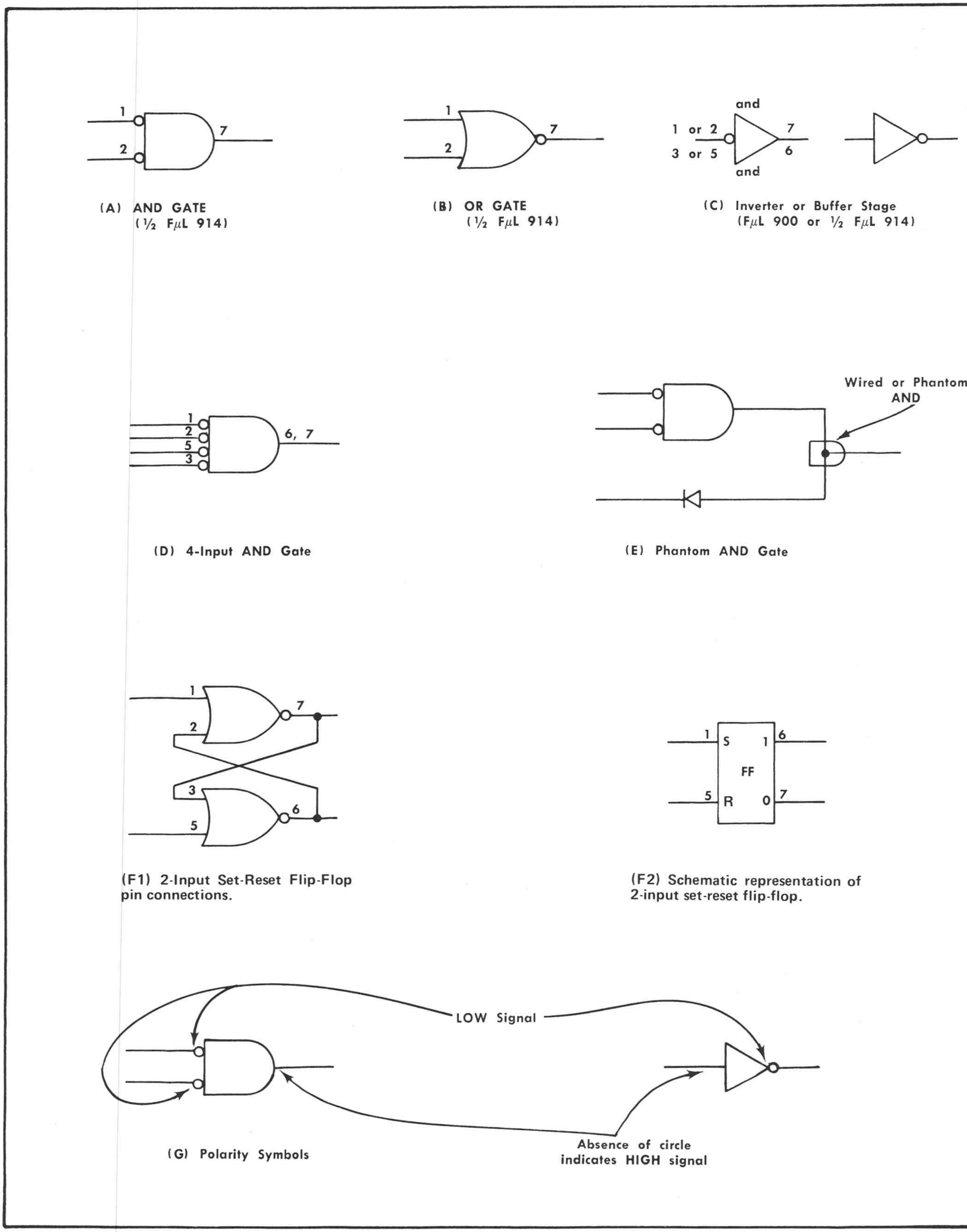


Fig. 3-5. Type FμL 914 micrologic symbols and configurations as used in Type 142/R142.

6 must be low. This is one stable state. To cause a change, a high is coupled to pin 1. Pin 7 must go low, setting pin 3 low. Assuming that pin 5 is also low, pin 6 (the output) will change to high. If pin 5 had been high due to a signal, the transition could not have occurred at that time.

Having changed to high on pin 6, the flip-flop will stay in this state until a high appears at pin 5. When this happens, pin 6 goes low, pin 7 goes high and the cycle is completed.

In typical operation, the desired output is a positive pulse (high). A high or positive signal at pin 1 starts the positive pulse output at pin 6. Later, a high at pin 5 terminates the positive pulse out. Time between highs at pin 1 and pin 5 determines the pulse width. Fig. 3-6 illustrates normal operation for the Set-Reset Flip-Flop.

Type FμL 923 JK Flip-Flop

Fig. 3-7 (A) shows the basic configuration when using the Type FμL 923 as a triggered divide-by-two counter. To trigger, a negative-going transition is required at pin 2. The output pins (5 and 7) exchange polarity each time a negative-going transition arrives at pin 2. For example, the first trigger at pin 2 may cause pin 5 to go low. The next trigger sets pin 5 high. Pin 5 will go low every other trigger into pin 2, resulting in a divide-by-two countdown. When pin 5 is low, pin 7 is high and vice versa, similar to the two sides of a multivibrator.

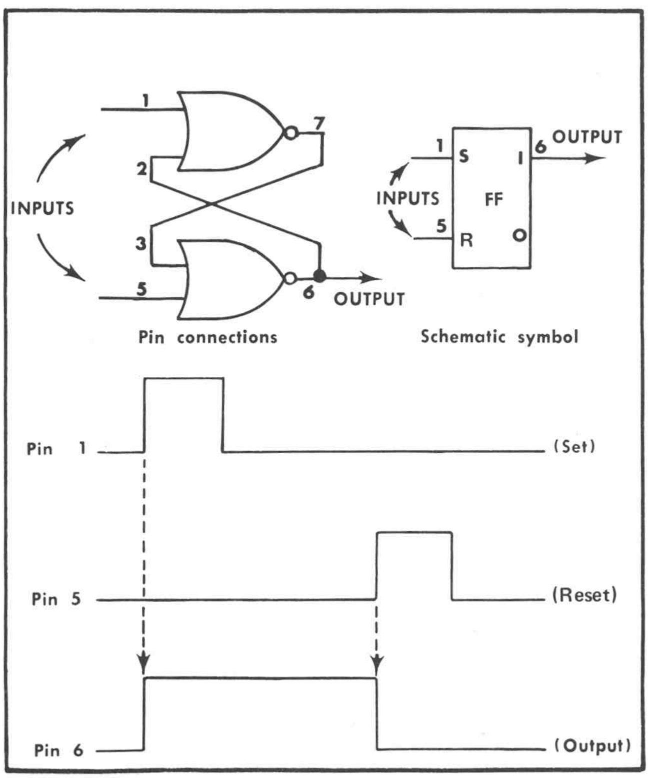


Fig. 3-6. Typical operation of 2-input Set-Reset Flip-Flop.

In Fig. 3-7 (B), pin 6 is shown as an active element. This pin is typically used to preset the flip-flop so that the output pins start with the desired polarity at a certain time. When pin 6 is high, pin 5 will be high and pin 7 will be low. The high at pin 6 overrides any trigger input at pin 2 so that the flip-flop can always be started with the desired polarity. When the high is no longer present at pin 6, the unit can resume triggered operation under control of pin 2.

A gated counter is illustrated in Fig. 3-7 (C). In this configuration, operation is similar to the triggered counter except that the flip-flop is inhibited from changing states during the time that pins 1 and 3 are high. When pins 1 and 3 are low, negative-going transitions at pin 2 will trigger the flip-flop in the normal manner.

In Fig. 3-7 (D), separate controlling signals are coupled into pins 1, 2, and 3. As in the gated counter, if pins 1 and 3 are both high, pin 2 cannot trigger the flip-flop. If pin 1 is high and pin 3 is low, the next negative-going transition at pin 2 will trigger the flip-flop so that pin 7 is high and pin 5 is low. If the flip-flop is already in that state when the trigger arrives at pin 2, no change will occur.

If pin 1 is low and pin 3 is high, the flip-flop will change states with a trigger at pin 2 as necessary to set pin 7 to low and pin 5 to high. Pin 7 output signal has the same polarity as pin 1 input signal and pin 5 output polarity will be the same as pin 3 input polarity.

When both pins 1 and 3 are low, the flip-flop will change states with each negative-going trigger at pin 2.

The preset input, pin 6, may be used in addition to the inputs at pins 1 and 3. A high coupled in to pin 6 will override any signals into pins 1, 2, and 3 and will preset pin 5 to high and pin 7 to low as previously described.

SUBCARRIER OSCILLATOR & OUTPUT ⟨10⟩ & ⟨11⟩

Subcarrier Oscillator

The Subcarrier Oscillator (Master Oscillator) is a crystal-controlled modified Colpitts oscillator with all critical components contained in a constant-temperature oven. Close control of oven temperature provides a frequency stability of better than ±5 Hz over an ambient temperature range of 0° to +50°C.

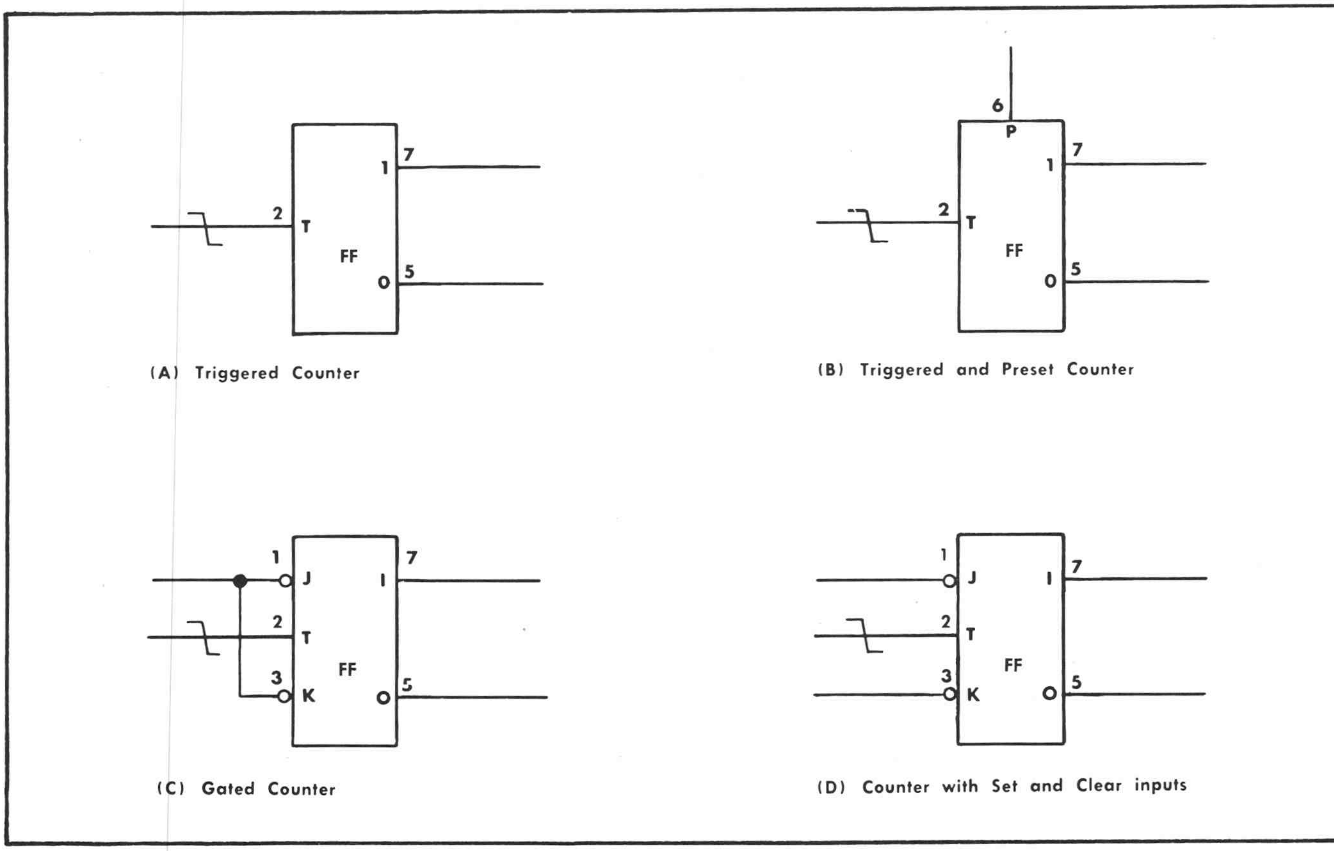


Fig. 3-7. Type FμL 923 micrologic symbols and configurations.

The oscillator consists of Y1126, CR1122, Q1126, and Q1127. CR1122 is a voltage-variable capacitance which permits adjustment of the oscillator frequency. R1195 sets the operating bias on CR1122, thus setting the oscillator frequency. R1194 and R1196 are factory-selected to provide an adjustment range of ±10 Hz about 3.575611 MHz. Q1127 supplies the sustaining feedback for the oscillator and serves as the output driving stage.

The use of two transistors (Q1126 and Q1127) in the oscillator allows the loop gain to be made non-critical with regard to transistor parameters and to be set so that the oscillator operates at approximately a 50% duty cycle.

Q1105 and Q1106 comprise the output stage of the oscillator. The oscillator signal is emitter-coupled from Q1105 to Q1106, which operates as a switching pair. A pulse current is determined by R1105 and drives the tank circuit, L1147, C1149, and C1152. The Q of the tank, and thus the subcarrier amplitude at the output, is determined by R6772 and R6782 on the Line Timing board. From the collector of Q1106, the subcarrier signal is coupled to the Subcarrier Source Switching circuitry.

When the front-panel REF switch is set to EXT, +3.6 V is applied to the anode of CR1105 and thence to the emitters of Q1105 and Q1106. This reverse-baises both stages and thus eliminates the subcarrier signal in the collector circuit of Q1106.

Master Oscillator Oven

Oven temperature is sensed by a bridge network consisting of R1134, R1135, R1136, and R1137. R1134 and R1137 are not sensitive to temperature, while R1135 and R1136 are nickel resistive elements with a temperature coefficient of +0.55%/°C.

When the oven is cold, R1136 is lower in resistance than R1134, making the base of Q1135B more negative than it is when the bridge is balanced. The collector of Q1135B is therefore more positive. This more positive level is coupled to the base of Q1133, which is an emitter-follower coupled to the base of Q1131, the driver for the heating element (R1131). The positive level on the base of Q1131 causes heavy conduction through the heating element and thus rapid heating of the oven chamber.

As the oven approaches normal temperature, R1136 increases in resistance, driving the base of Q1135B in a positive direction. This results in a less positive level at the base of Q1131, reducing the current through the heating element until a balance is achieved. At normal operating temperature, most of the heat is supplied by the power dissipation of Q1131. Normal temperature is about +85° C.

Oven Temperature Lamp

Normal operating temperature for the oven is indicated by a front-panel lamp which glows when the oven is at the proper temperature. The lamp is extinguished when the oven is either below or above normal temperature.

When the instrument is first turned on and the oven is cold, R1135 in the sensing bridge is lower in resistance than R1137, and the base of Q1135A is less negative than when the bridge is balanced. Q1135A collector current is greater, increasing the voltage drop across R1112. This sets the voltages in the divider consisting of R1112, R1114, CR1115 and R1116 so that Q1111 is cut off and CR1110 is in conduction through R1110. The resulting level at the base of Q1101, the lamp driver, holds Q1101 in cutoff. DS88, the indicator lamp in the collector circuit of Q1101 is off.

At normal temperature, R1135 and R1137 in the bridge are equal and the base of Q1135A is more negative than when the oven was cold. Collector current of Q1135A decreases, causing less voltage drop across R1112. This biases CR1110 cathode to a slightly positive voltage, thus allowing Q1101 to go into saturation, turning the indicator lamp on.

If the oven temperature should happen to rise above normal, R1135 will increase in resistance, making the base of Q1135A more negative than normal. This decreases collector current through R1112, causing the junction of R1112 and R1114 to become more positive. The base of Q1111 is now more positive, bringing Q1111 into conduction. The drop across R1110 causes the base of Q1101 to drop, cutting off the collector current through the indicator lamp, which then goes off.

The oven is protected from overheating (due to a failure in the temperature control circuit) by the thermal cut-out switch S1131.

SUBCARRIER and SYNC SOURCE SWITCHING 6b

Subcarrier Source Switching

The Subcarrier Source Switching circuit consists of S56 (REF), U635A, Q686, Q696, CR677, CR697, Q687 and Q688. (See Fig. 3-8.)

When the REF switch is set to INT, the base of Q696 is at approximately +2.9 V and Q696 is in saturation. The collector of Q696 is at approximately +3.5 V, biasing CR697 off. Inverter U635A sets the base of Q686 at approximately +3.5 V, causing Q686 to be near cutoff. The collector of Q686 is at approximately 0 V, permitting CR677 to be fully on.

The internal subcarrier is coupled through C679, R6782 and CR677 to Q687 and Q688, which are connected as an operational amplifier.

The base of Q677 is also set to approximately +3.5 V by U635A. Q677 is cutoff, thus allowing the current through R6781 to bias CR676 fully on. C678, R6772 and CR676 couple the internal subcarrier signal to the Phase Lock Reference Amplifier consisting of Q674, Q675, Q684 and Q694. From the Phase Lock Reference Amplifier, the signal is coupled to the Phase Lock Sampler to provide synchronization of the subcarrier and line sync signals.

When the REF switch is set to EXT, +3.6 V is applied to the top end of divider R6250-R6260. At the bases of Q677 and Q686, the voltage is now at approximately +2.9 V. Q677 and Q686 are in saturation with their collectors at approximately +3.5 V. CR676 and CR677 are biased off, so that any internal subcarrier signal present is diverted through Q677 and Q686. Also, with the REF switch set to EXT, +3.6 V is applied through CR1105 to the emitters of Q1105 and Q1106, the internal oscillator output stage (previously described). The bases of Q676 and Q696 are set to approximately +3.5 V, causing them to be cutoff. CR675 and CR697 are biased on via the current through R6780 and R6980 respectively.

The external subcarrier signal is coupled through R6990, C699 and CR697 to the Subcarrier Amplifier (Q687 and Q688).

Ext Sync Processing

If external composite sync is applied to the instrument, this signal is coupled through Q656, which serves as a termination for the input signal. Thence the signal is coupled through the Ext Horiz Sync ramp generator consisting of Q666, Q667, Q668 and Q669 via R6770 and CR675 to the Phase Lock Reference Amplifier. The signal is then coupled to the Phase Lock Sampler.

Q666 and Q667 are a switching pair which convert the sync pulses to constant current pulses from the collector of Q667. Q669 is normally saturated, but during a sync current pulse it generates a 2.5 V/μs ramp. The top of the rampxis limited at 5 V by Q668. After the sync pulse,

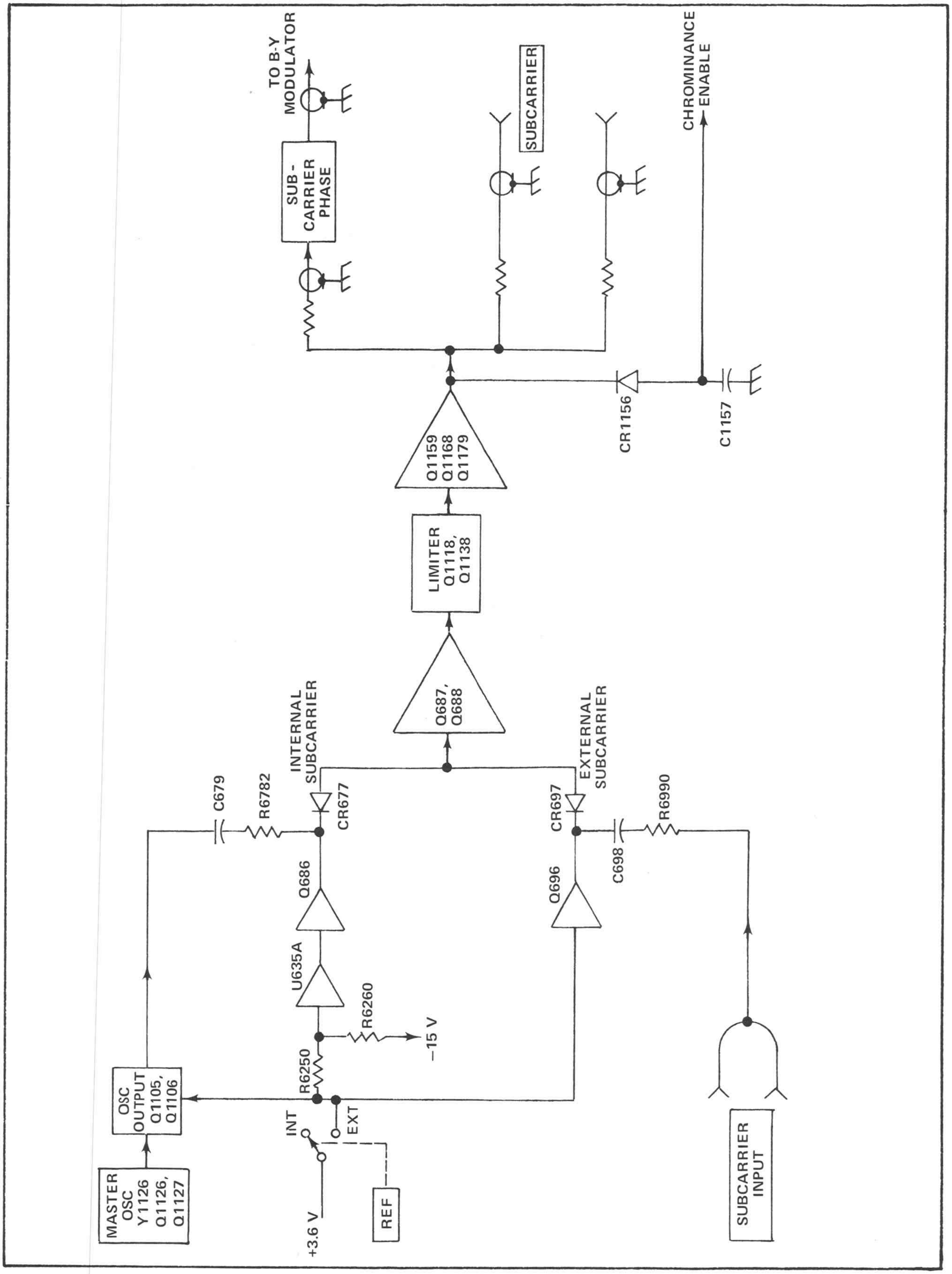


Fig. 3-8. Block diagram of Subcarrier Source Switching circuit.

R6770 becomes a current source of opposite polarity so the ramp goes in the opposite direction back down to approximately 0 V.

The purpose of integrating the external horizontal sync pulses is to eliminate most noise impulses from the output signal and provide a ramp to be sampled. (See Fig. 3-9.)

The external composite sync signal is also coupled to the Ext Vert Sync ramp generator and peak detector consisting of Q646, Q647, Q648, CR648 and Q649 and thence to U619 to initiate a field preset signal.

Q646, Q647 and Q648 form a vertical ramp generator similar to the Ext Horiz Sync ramp generator except the time constants are much longer. The entire field sync pulse duration (3 lines) is required for the ramp to reach 5 volts. Thus, line sync pulses, equalizing and noise signals have no appreciable effect.

At the exact peak of the ramp, the point is reached at which CR648 is forward biased. This occurs near the end of the last serrated pulse. (See Fig. 3-9.) The conduction of CR648 through C647 and R6480 briefly (approximately 10 μs) turns on Q649, resulting in a negative-going impulse at the collector of Q649. R6490 and C649 provide positive feedback, making the peak detection more definite.

Goniometer Drive and Subcarrier Output Amplifier 11

The subcarrier signal appearing at pin connector N is coupled through the Limiter (Q1118 and Q1138) to the Goniometer Drive and Subcarrier Output Amplifier consisting of Q1159, Q1168 and Q1179.

L1197 is tuned to resonance at the subcarrier frequency. Q1168 and Q1179 act as a switching pair for the current from R1121.

Q1159 and Q1179 are connected as an operational amplifier. From the amplifier,wthe subcarrier signal is coupled to the front- and rear-panel SUBCARRIER output connectors and to the goniometer (SUBCARRIER PHASE).

Chrominance Enable 11 and 4b

The Chrominance Enable circuit consists of CR1156, C1157, Q471, Q481 and Q491. The purpose of this circuit is to eliminate extraneous noise which may appear at the Video Output Amplifier when no subcarrier signal is present.

When the subcarrier signal is present as an output from the emitter of Q1159, CR1156 is forward biased during the negative half-cycles, putting a negative-voltage charge across C1157 and at pin connector K.

This negative voltage at pin K is coupled to pin AW on the Bar Drive and Video Out board and thence to the base of Q471. Q471 is then forward biased, with its collector becoming less negative. The divider R461, R471 and R491 sets the base of Q481 to several volts positive, reverse-biasing the base-emitter junction of Q481. The base of Q491 becomes negative, cutting off current through Q491.

In the absence of a subcarrier signal at CR1156, Q471 is reverse-biased, Q481 is forward-biased and Q491 is in saturation. Noise signals at the junction of C491 and R481 are shunted to ground through C491 and Q491.

LINE TIMING 6a

Phase Lock Sampler

The Phase Lock Sampler circuit consists of U633, Q645, T655, C655, C665, R6540, R6640, CR654 and CR664.

The circuit samples a signal from either the internal subcarrier oscillator or integrated external horizontal sync with the output from U633, a four-input AND gate. Pin 1 of U633 is from the External Sync Position circuit (Line Detail Timing). When the REF switch is set to EXT, pin 2 of U633 is low, permitting the External Sync Position signal to be coupled through U633A. With the REF switch set to INT, a gate at 1/4 line rate is coupled to pin 2 of U633A, effectively blocking the External Sync Position signal at pin 1. Pins 3 and 5 are driven by 15,734 Hz and 7867 Hz signals from the Line Counter, causing the output of U633 to be a sub-harmonic of the Line Frequency Control Oscillator as well as of the sub-carrier frequency. The sampling rate is increased to the line rate when sampling external horizontal sync.

The resulting output from the Phase Lock Sampler is a DC voltage which is used to phase lock the Line Frequency Control Oscillator frequency to an exact ratio (128:455) with respect to the subcarrier oscillator frequency or the external horizontal sync rate (64:1).

The signal at the junction of CR654 and CR664 is either sinewaves at the subcarrier frequency or integrated horizontal sync pulses from the Phase Lock Reference Amplifier. The sync pulses are limited, integrated and amplified in order to provide a positive-going ramp to be sampled. The waveforms are symmetrical from zero volts (equal positive and negative excursions).

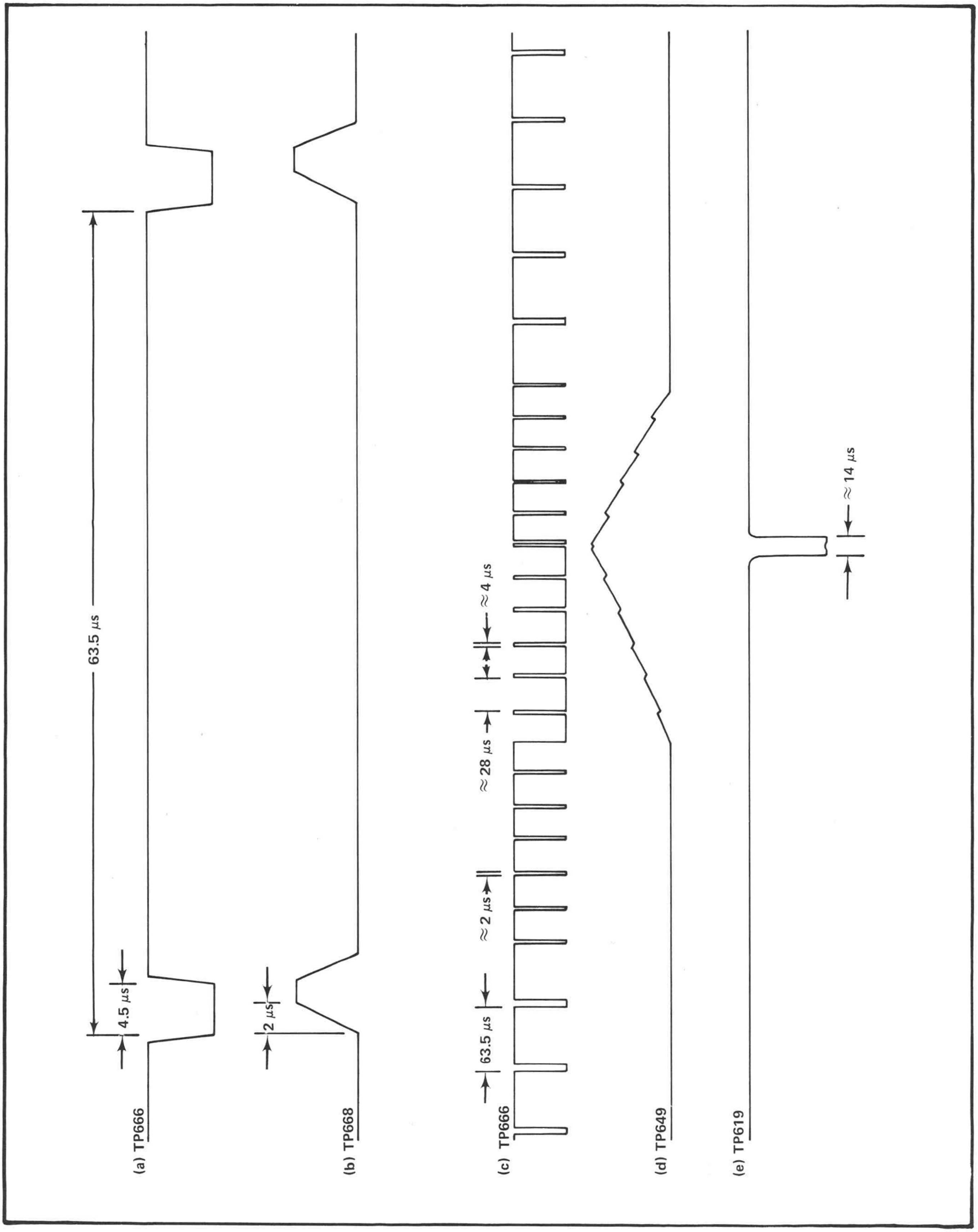


Fig. 3-9. Time-related waveforms in the Ext Horiz Sync Amp (a and b) and the Ext Vert Sync Amp (c, d, and e).

The output from U633 is a positive pulse occurring at one-half the line rate (7867 Hz) when sampling the subcarrier and the line rate (15,734 Hz) when sampling external sync. This signal is applied to the base of Q645, driving Q645 into cutoff. (Q645 is normally in saturation.) The collapse of field in the primary of T655 causes a negative spike approximately 50 ns wide at the collector of Q645. This narrow spike appears across the secondary of T655, with about −5 V at the C665 end and +5 V at the C665 end. This forward biases CR654 and CR664, which couples the voltage at the diode junction (less the diode drops) to the diode ends of C655 and C665 respectively.

After the pulse, the transformer end of the capacitors returns to ground potential, causing the diode ends of C655 and C665 to be −5 V (plus diode drop plus sampled voltage) and +5 V (less diode drop plus sampled voltage) respectively. The voltage now appearing at TP663 is the average of these two voltages, or simply the sampled voltage.

If the spike occurs at the time that the waveform at the junction of CR654 and CR664 passes through zero volts, the result at the junction of R6540 and R6640 will be zero volts. When the spike occurs at a negative or positive voltage, the output will be either a negative or positive voltage. (See Fig. 3-10.)

DC Control Loop Amplifier

Q673A, Q673B, Q683 and Q693 comprise the DC Control Loop Amplifier circuit.

To provide minimum loading of the Phase Lock Sampler circuit, a FET (Q673A) is used as the input stage of the amplifier. Q673A is connected as a source-follower, driving the base of Q683. The inverted and amplified output signal at the collector of Q683 is applied to the voltage-variable capacitance (CR653) through R6630.

Q673B and Q693 serve as temperature compensation. C654 limits the bandwidth of the amplifier to stabilize the control loop, and R6631/C663 decrease the loop gain at medium frequencies to increase noise immunity.

Line Frequency Control Oscillator

The Line Frequency Control Oscillator, consisting of Y643, CR653, Q643 and Q644 is a modified Colpitts configuration. CR653 is a voltage-variable capacitance which alters the frequency of the oscillator in relation to the voltage from the Phase Lock Sampler circuit. A negative-going voltage at the cathode of CR653 increases the capacitance of the diode, lowering the frequency of the oscillator.

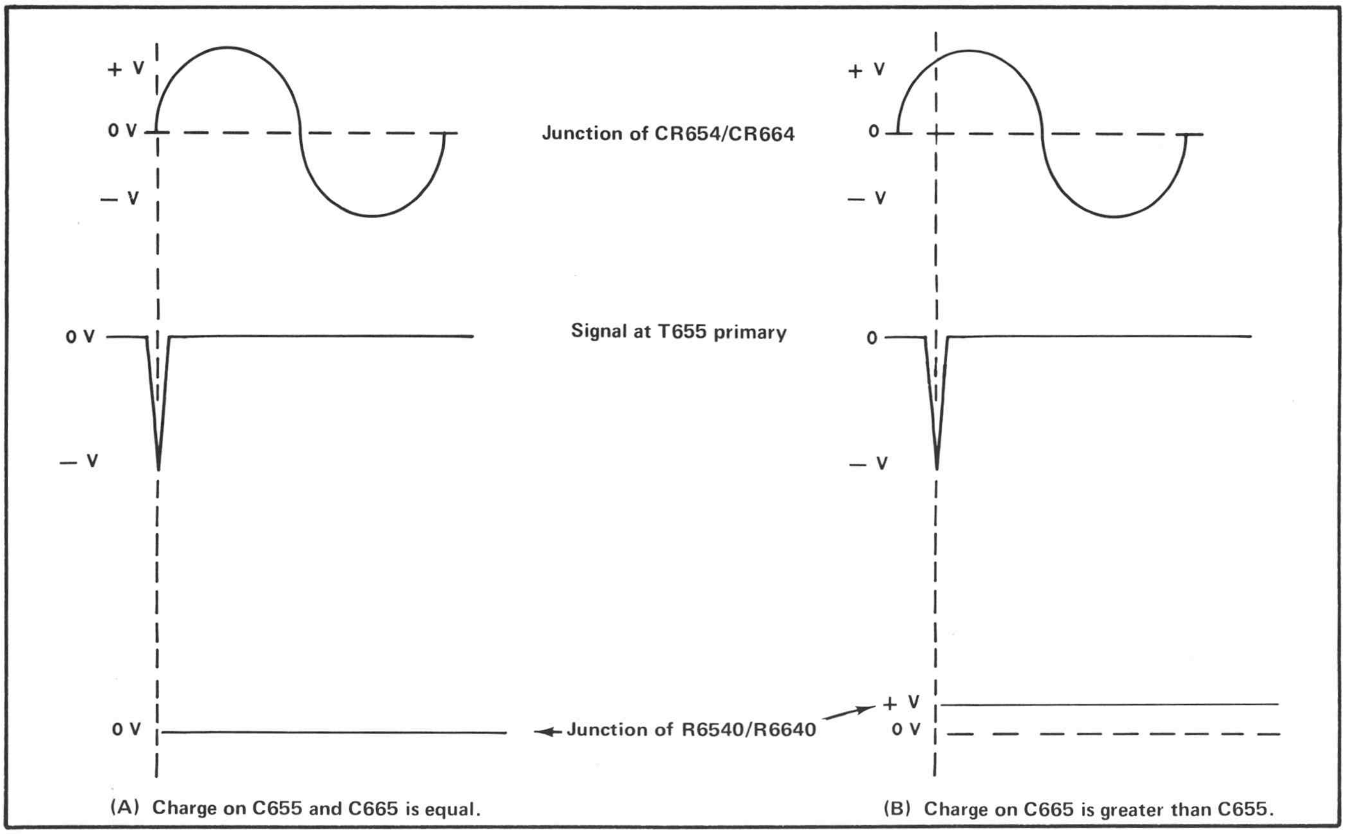


Fig. 3-10. (A) Action of Phase Lock Sampler at balance and (B) when unbalanced. In example (B), frequency of the Line Frequency Control Oscillator is too low and the level at the junction of R6540/R6640 will cause the frequency to increase.

Q644 supplies the sustaining feedback to the oscillator circuit and serves as the output driving stage. Biasing is approximately Class B, with the collector output signal being a clipped sine wave. Q643 provides additional gain, so that the overall gain can be degenerated, and thus more independent of transistor parameters.

The collector signal from Q644 triggers U636 in the Line Counter circuit.

Line Counter

The Line Counter circuitry, consisting of U615, U616B, U617, U625, U626, U627, U629, U636, U637 and U639, generates signals at the horizontal line rate and other harmonically related signals to drive the micrologic units which comprise the Line Detail Timing, Burst Logic, Comp Sync Logic, Bar Osc Start and Bar Preset, Horiz Drive Gate and Vert Preset circuits. Other output signals are used in the timing sequences for the Field Counter, Video Logic, VITS Logic, Crosshatch and Dot Generator and Line Blanking circuits.

U625, U626, U627, U629, U636, U637 and U639 are Type FμL 923 JK Flip-Flop micrologic units connected as divide-by-two counters. See Integrated Circuits for a description of the operation of this configuration.

The first unit in this counter train (U636) is triggered by the Line Frequency Control Oscillator. The output signal at pin 5 is negative-going pulses at a rate of approximately 500 kHz. The output signals of each succeeding counter stage are at a rate which is one-half the input rate. The output of U626 is at the line rate (15,734 Hz). U625 is locked in the state which holds pin 7 low when the generator is in the external sync mode of operation. This allows the Phase Lock Sampler to run at the line rate.

Bar Osc Start and Bar Preset

The Bar Oscillator Start (U609) and Bar Preset (U607) circuits each consist of a four-input AND gate. The inputs are various timing signals from the Line Counter circuit.

Horiz Drive Gate

The Horiz Drive Gate circuit consists of Q610 and U601. U601 is a Set-Reset Flip-Flop (see Integrated Circuits). The set input is a line rate signal from the Line Counter. The H Sync Stop signal from the Line Detail Timing circuit is coupled through Q610 to pin 5 of U601 to serve as a Reset signal.

Comp Sync Logic

The Comp Sync Logic circuit consists of U603, U605, U606 and U613. U605 is a Set-Reset Flip-Flop with one set input and three reset inputs. The set input signals are the H Sync Start signal from the Line Detail Timing and either Keyout from Field Logic or approximately 15 kHz from the Line Counter. The flip-flop is set at a 15,734 Hz rate except during the keyout, when it is set at a 31,468 Hz rate.

The reset inputs are the Equalizer Gate from Field Logic, Equalizer Stop from Line Detail Timing, H Sync Stop from Line Detail Timing, Keyout from Field Logic and the field sync reset derived from the Line Counter.

Burst Logic

The Burst Logic circuit consists of Q642, Q652, U602, U612B and U623.

U602 is a Set-Reset Flip-Flop which is set by a combination of the Burst Start signal from Line Detail Timing, the Keyout signal from Field Logic and a 15,734 Hz timing signal from the Line Counter.

The reset signal for U602 is coupled to pin 3 through U612B from Q642 (Burst Stop) in Line Detail Timing.

Field Preset Gate

U616A and U619 comprise the Field Preset Gate circuit. U616A serves to invert the "high" present at pin 1 whenever the REF switch is set to EXT. With the REF switch set to INT, a low is coupled to pin 1 of U616A. Inversion of the low to a high at pin 1 of U619 prevents the Field Preset Gate from functioning.

A 31,468 Hz signal from the Line Counter is coupled to pin 2 of U619. A negative-going pulse from the Ext Vert Sync peak detector is coupled to pin 5 of U619 (whenever external sync is supplied to the instrument). The pulse from the peak detector may be present during the transition from one line toxthe next. ANDing the pulse with the 31,468 Hz signal insures that the field preset signal will be generated only during a single line.

When pins 1, 2 and 5 of U619 are all low, a positive-going field preset pulse is present at pins 6 and 7 and thus at pin connector U.

Line Detail Timing

The Line Detail Timing circuit consists of U635B, U612A, Q621, Q622, Q662, Q672, Q682, Q691, Q692, CR621 and CR622. The circuit provides signals to the Comp Sync Logic circuit to control horizontal sync start and stop, equalizer stop, burst start-stop functions and a signal to permit adjustment of coincidence between the internal sync and an externally applied sync.

A symmetrical square wave at twice the horizontal line rate is coupled through U635B to Q621 and Q622, which are connected as a conventional Miller integrator. C631 and R6221 are the integrator timing components. Output of the integrator at the emitter of Q621 appears as a trapezoidal waveform. This signal is applied across resistive dividers in the base circuits of Q642 and Q652 in the Burst Logic circuit.

Fig. 3-11 illustrates the operation of the horizontal sync start circuit (Q691). Q642, Q652, Q662, Q672 and Q682 operate in a similar manner.

Q692 serves as a temperature compensation for the Miller integrator and Q642, Q652, Q662, Q672, Q682 and Q691.

FIELD TIMING ⟨3⟩

Circuits on the Field Timing board include the Field Counter, Field Logic, VITS Logic and Video Logic.

Field Counter

The Field Counter circuit consists of U301, U302, U304, U306, U308, U309, U321, U322, U324, U326, U328, U329 and U349A, Q311, Q312, Q314, Q316, Q317, Q318 and Q319.

The circuit is primarily a series of JK Flip-Flops, connected as a 525-state preset binary counter. The preset occurs at the beginning of video line 262. When Ext Comp Sync is applied, the Field Preset pulse serves as a second preset signal, being coupled by Q311 through Q319 to the appropriate counters to preset the counter to video line 7. A 31.25 kHz square wave from the Line Counter is coupled to pin 2 of U309 to start the counting sequence.

Output signals from the Field Counter are coupled to the VITS Logic, Field Logic, Bruch Logic, Field 1 & 3 Preset Gate, and Video Logic circuits. Time relation of the output signals is shown on the pull-out diagram labeled Field Timing Details at the back of the manual.

Field Logic

The Field Logic circuit includes U336, U338,xU341, U342, U344, U346A, U348, U349B, U362, U364 and U372A.

The circuit is driven from various timing signals originating in the Field Counter circuit. Timing signals are combined in multiple-input AND gates to develop set and reset input signals for various Set-Reset Flip-Flops. Generation of the Keyout signal will be described as an example.

When the three inputs of U342, (pins 1, 2 and 5) are all simultaneously low, the output (pins 6 and 7) goes high. Since the lows are simultaneous for only a short time, the output is a positive pulse. This positive pulse is coupled to the set input (pin 1) on U362, the Keyout Gate. When the gate is set, the 'one' output, pin 6, goes high (positive). Later, when pins 3 and 5 on U344B are both low, pin 6

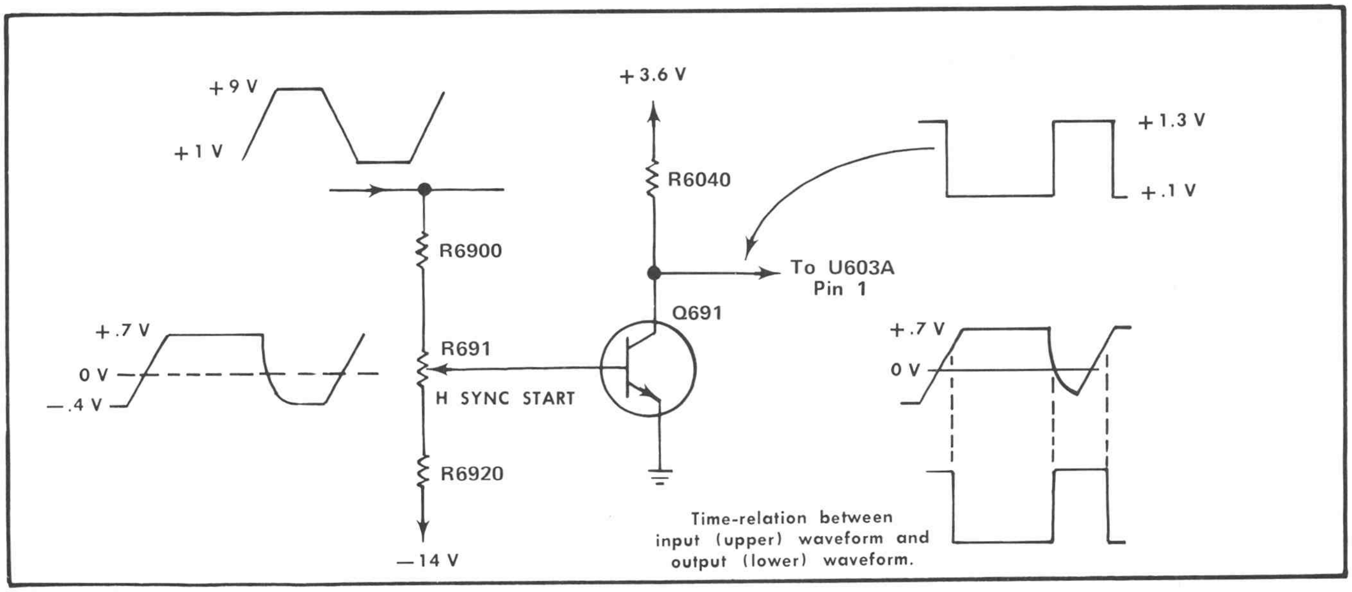


Fig. 3-11. H Sync Start circuit. Adjustment of R691 will select the point on the input ramp at which Q691 turns on, thus adjusting the time when the negative-going transition at the output occurs.

goes high. The high is coupled to the reset input (pin 5) on U362, causing the 'one' output (pin 6) to return to low. The Keyout signal is therefore a positive pulse which starts when the set input of U362 goes high and ends when the reset input goes high. The Keyout signal is coupled to pin connector BA and thence to Comp Sync Logic and Burst Logic.

A negative keyout gate appears at the 'zero' output (pin 7) of U362. This signal is coupled to U372A to combine with the 'one' output of the Serration Gate, U364. When these two signals are low, a positive equalizer gate is generated,at pin 7 of U372A.

Other signals generated in the Field Logic circuit include Vert Drive, and the set pulse for the Split Field Gate and Field,Blanking Gate.

VITS Logic

The VITS Logic circuit includes[U346B, U366, U368 and U369. U366 is connected as a Set-Reset Flip-Flop and the other micrologic units are negative-input AND gates.

Fig. 3-12 illustrates the various signals related to VITS Logic in proper time-relation to each other. Note that nine different signals must be in the 'low' state to initiate the VITS gate.

Video Logic

The Video Logic section encompasses several related circuits which determine whether the line video will be STAIRCASE or COLOR BAR. Selection of the VITS video signal (STAIRCASE or COLOR BAR) is also accomplished in this circuitry.

The Video Logic circuitry consists of U334, U361, U371, U372B, U374, U376, U378, U379, U396, U399 and Q333, Q381, Q384, Q385, Q388, Q394, Q397 and Q398.

Since operation of the Video Logic circuits depends on settings of the TEST SIGNAL, VITS TEST SIGNAL, and REF switches, a setting for each switch will be assumed and the circuitry will be explained under these conditions. Please refer to Fig. 3-13 for a simplified block diagram.

Assume the switches are set as follows:

Switch	Setting
TEST SIGNAL	COLOR BAR
TEST SIGNAL (VITS)	STAIRCASE
REF	INT

The positive level into the Video Selector Drive provides an electronic switch to ground which is coupled to the TEST SIGNAL switch. This ground is also coupled to the VITS Color Bar Enable and VITS Staircase Enable stages. With the TEST SIGNAL switch in the COLOR BAR position, the ground is coupled to the Color Bar Split Field Drive and Color Bar Full Field Drive circuits.

The Field Blanking signal is also coupled to the Color Bar Full Field Drive circuit, blocking the full field drive signal during the field blanking interval. The Field Blanking and Split Field Gate signals drive the Color Bar Split Field Gate, which is coupled to the color Bar Split Field Drive circuit. The Split Field Gate eliminates the color bar U and/or V components during the last 60 lines in each field.

With the TEST SIGNAL (VITS) switch set to STAIRCASE, the VITS Enable Gate signal is coupled through the switch to the VITS Staircase Enable circuit. A video enabling signal is also coupled to the VITS Staircase Enable circuit from the Video Selector Drive circuit. When both of these signals are present at the input of the VITS Staircase Enable, a ground appears at pin connector M.

APL Logic

The APL Logic circuit includes U372B, U374, U376, U378 and U379, serving as a divide-by-five counter. U374, U376 and U379 are connected as JK Flip-Flops. (See Integrated Circuits.)

In the 50% position of the APL switch, pin 7 of U379 is grounded (low). In all other positions of the APL switch, pin 7 of U379 is low for one line, while pin 5 is low for four lines. Pin 7 is coupled to the Staircase Field Gate and pin 5 is coupled to the APL Field Gate. This circuit accomplishes the four lines of APL and one line of staircase display mode.

U372B supplies the preset pulse for the divide-by-five counter and also generates the reset signal for the Video Enable Gate.

BAR TIMING ⟨2⟩

Bar Oscillator

The Bar Oscillator circuit consists of Q206, Q216 and Q236. L217 and C218 are the oscillator tank elements. Q206 and Q216 are the active oscillator elements, with Q216 supplying the sustaining feedback. Q236 serves as the oscillator output stage. CR202 and CR206 in the tank circuit serve to limit the amplitude of oscillation.

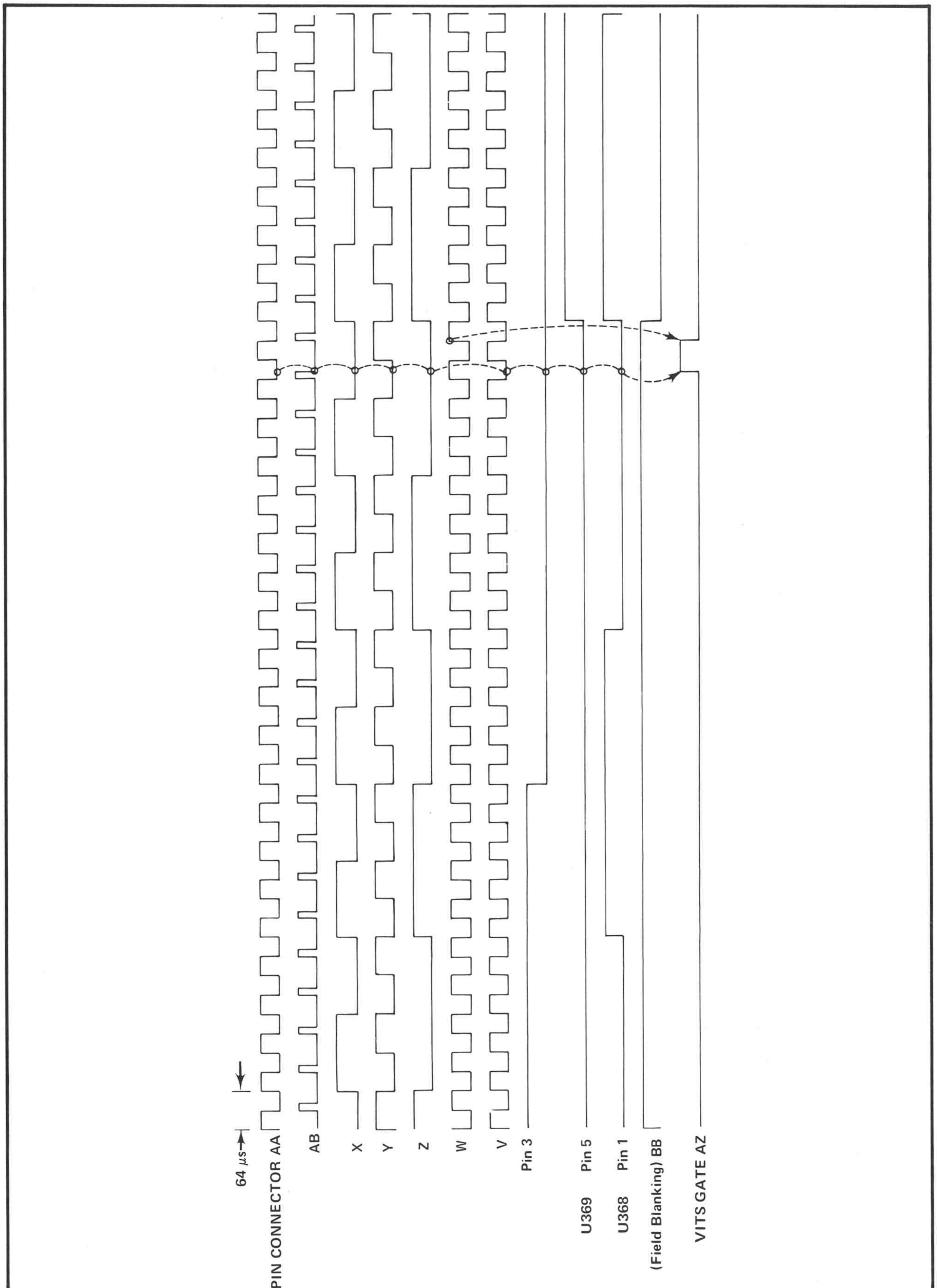


Fig. 3-12. VITS Logic input, output, and related waveforms. VITS selected is Line 18, Fields 2 & 4.

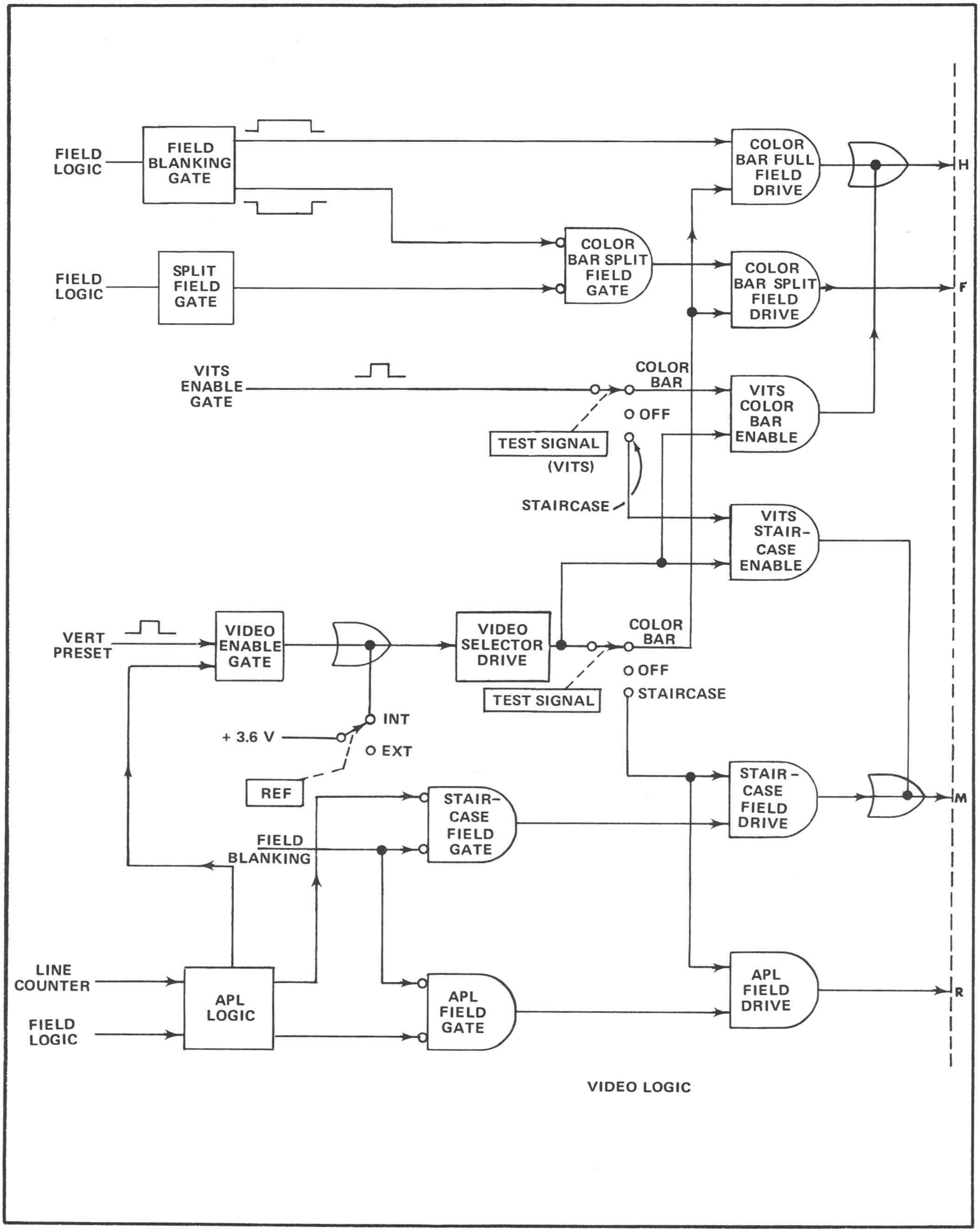


Fig. 3-13. Block diagram of Video Logic circuits with logic symbols.

Q216 and Q236 act as a current switch which changes state at the "0" crossing of the sine wave at the base of Q216, resulting in a square-pulse output across R234 in the collector circuit.

÷ 4 Counter

The ÷4 Counter consists of U243, U245 and U247. U243 and U245 are JK Flip-Flops, each connected to count down by two. The 600 kHz output from the oscillator is used to trigger U243. This frequency is divided down to 300 kHz by U243 and then down to 150 kHz by U245. The output of the counter is coupled through U247 to the Luminance Delay and Color Bar Chroma Counter and Logic circuits.

Bar Oscillator Start-Stop Control

U253 and U226 comprise the Bar Oscillator Start-Stop Control circuit. The oscillator is gated off during the interval between the end of the blue chroma color bar and one cycle before the start of the white level bar.

The Bar Osc Start signal appears at pin connector Z and is coupled to pin 1 on U253. The signal is a positive pulse which causes the output (pins 6 & 7) of U253 to go low. This cuts off Q226, permitting the bar oscillator to start. The oscillator starts instantly since R218 had been supplying the normal operating peak current through L217. The current is diverted to C218 when Q226 turns off, thus starting oscillation. The various timing signals from the Color Bar Chroma Counter & Logic circuit serve to hold Q226 at cutoff until the end of the blue chroma bar, at which time the output of U253 goes high, turning on Q226. With Q226 in saturation, the base of Q216 is nearly grounded, preventing oscillator action.

Luminance Delay

The Luminance Delay circuit consists of C252, R235, R238 and Q237. R235 is adjustable to provide the proper delay between color bar chrominance and luminance drives.

The pulse signals at pin 6 of U247 are differentiated in passing through C252, resulting in positive- and negative-going spikes as a signal applied to the base of Q237. R235 (Delay adjustment) varies the RC time constant of the waveform, thus setting the charge time of C252.

Q237 is normally biased at saturation. The negative-going excursions at the base bring Q237 into cutoff. Duration of cutoff is determined by the width of the negative-going spike at cutoff. See Fig. 3-14.

U258, U268 and U278 are triggered by a negative-going excursion. Duration of the positive pulse from Q237 determines the delay time at which the negative excursion occurs.

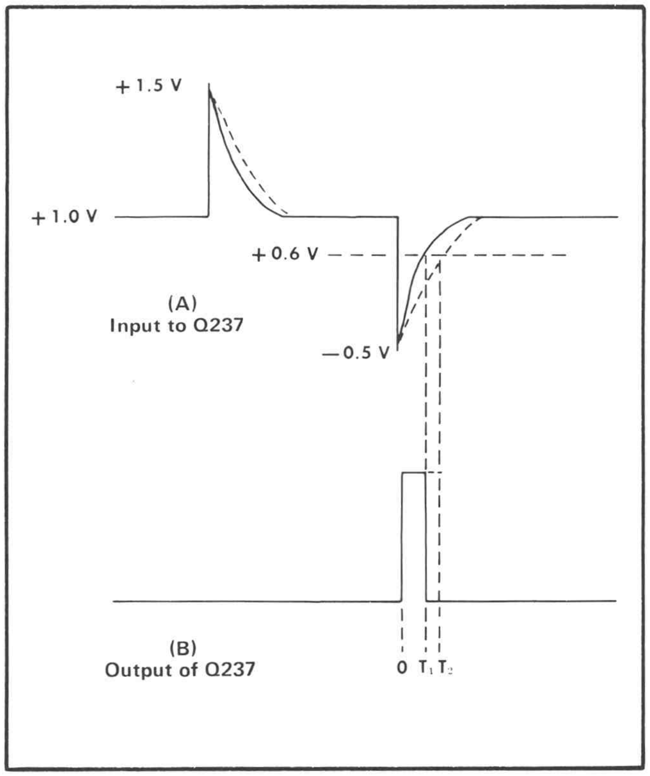


Fig. 3-14. Input and output waveforms for Q237. T_1 and T_2 are delay times with R235 set at each limit of adjustment.

Color Bar Chroma Counter & Logic

U255, U257A, U265, U275, and U277 are the Color Bar Chroma Counter & Logic elements. U255, U265 and U275 are connected as JK Flip-Flops with preset inputs forming a synchronous counter. Operation of this configuration may be found described under Integrated Circuits. This circuit performs the counting and logic functions which convert the oscillator ÷4 signals into related green, red and blue chroma gate signals. Output from the Color Bar Chroma Counter & Logic circuit is coupled to the Staircase Timing Logic, Color Bar Chrominance Amplitude and Bar Oscillator Start-Stop Control circuits.

Color Bar Luminance Counter & Logic

U257B, U258, U267, U268 and U278 comprise the Color Bar Luminance Counter & Logic circuit. This circuit is similar to the Color Bar Chroma Counter & Logic circuit, except that luminance gates are generated corresponding to green, red and blue.

Output signals are coupled to the Color Bar Setup & Line Blanking and Color Bar Luminance Amplitude circuits.

Color Bar Setup & Line Blanking

U298, a Set-Reset Flip-Flop comprises the Color Bar Setup & Line Blanking circuit. The set signal originates in the Color Bar Luminance Counter & Logic circuit and the reset signal is a line rate pulse from the Line Counter circuit.

Color Bar and Setup Voltage Supplies

Q203, Q213, Q223 and Q233 serve as outputs for the voltages developed across the divider consisting of R201, R202, R213, R214 and R215. The color bar output voltage is changed in accordance with the setting of the front panel COLOR BAR AMPL switch. The output voltages are coupled to the Color Bar Luminance Amplitude and Color Bar Chrominance Amplitude stages.

V Burst Amplitude

The V Burst Amplitude stage includes Q252 and Q262, connected as a current switch. The Burst Flag signal is coupled to the base of Q252 via pin connector B from the Burst Blanking Logic stage. Magnitude of the current is set by R232, with the signal coupled through Q262 and R263 to pin connector BG and thence to the +V Filter.

When the BURST V switch is set to OFF, the signal current is diverted by CR261 and the +3.6 V supply.

STAIRCASE ⟨5⟩

Staircase Timing Logic

The Staircase Timing Logic circuit consists of U507, U508, U509, U517, U518, U519, U537, U538, U539, U547 and U548. This circuit is a series of 2-input gates and Set-Reset Flip-Flops which generate gating pulses of various widths.

The output signals are coupled to the APL Chroma, Staircase Chroma Amplitude and Staircase Luminance Amplitude circuits. (See Fig. 3-15 for output waveforms to Staircase Luminance Amplitude stages.)

Staircase Luminance Amplitude

Q514, Q516, Q523, Q524, Q525, Q526, Q533, Q534, Q535 and Q536 comprise the Staircase Luminance Amplitude stages.

Input signals to the Staircase Luminance Amplitude stages are shown in Fig. 3-15. Each waveform drives the base of a switching pair stage.

The switching pair stages are identical in configuration, so the circuit for Step 1 of the staircase (Q514 and Q516) will be described as an example.

The negative gate pulse arriving at the base of Q516 turns Q516 off, diverting the current through Q514. R562 in the common emitter circuit sets the magnitude of the current through Q514, thus setting the amplitude of the step.

At a later instant (approximately 6.5 μs later), a negative gate pulse arrives at the base of Q525, diverting current through Q523. This current is added to the current from Q514, combining in the common collector circuit.

Fig. 3-15 illustrates the additive result of combining the individual step currents.

CR514, CR523, CR524, CR533 and CR534 couple the negative step currents through R542 to the +3.6 V supply except when the staircase field drive is present at pin connector AG. When the STEPS switch is in the down position, the step currents are coupled through these diodes at all times.

APL Luminance Amplitude

The APL Luminance Amplitude circuit consists of Q543, Q545 and the front-panel switch, APL.

A negative line blanking signal is coupled to the base of Q545. The APL field drive, a negative gate, is coupled to the anode of CR545, preventing current flow through the diode during the gate. When the negative gate is not present, current flow from R545 is through the diode.

The line blanking signal diverts the current which normally flows through Q545 to Q543. Magnitude of the current is determined by the setting of S24 (APL), which selects the emitter series resistance.

The resulting current from Q543 is coupled through R535 to pin connector AL, combining with the staircase step currents.

Staircase Chroma Amplitude

Q532 and Q542 comprise the Staircase Chroma Amplitude circuit. This circuit is very similar to the APL Luminance Amplitude circuit previously described.

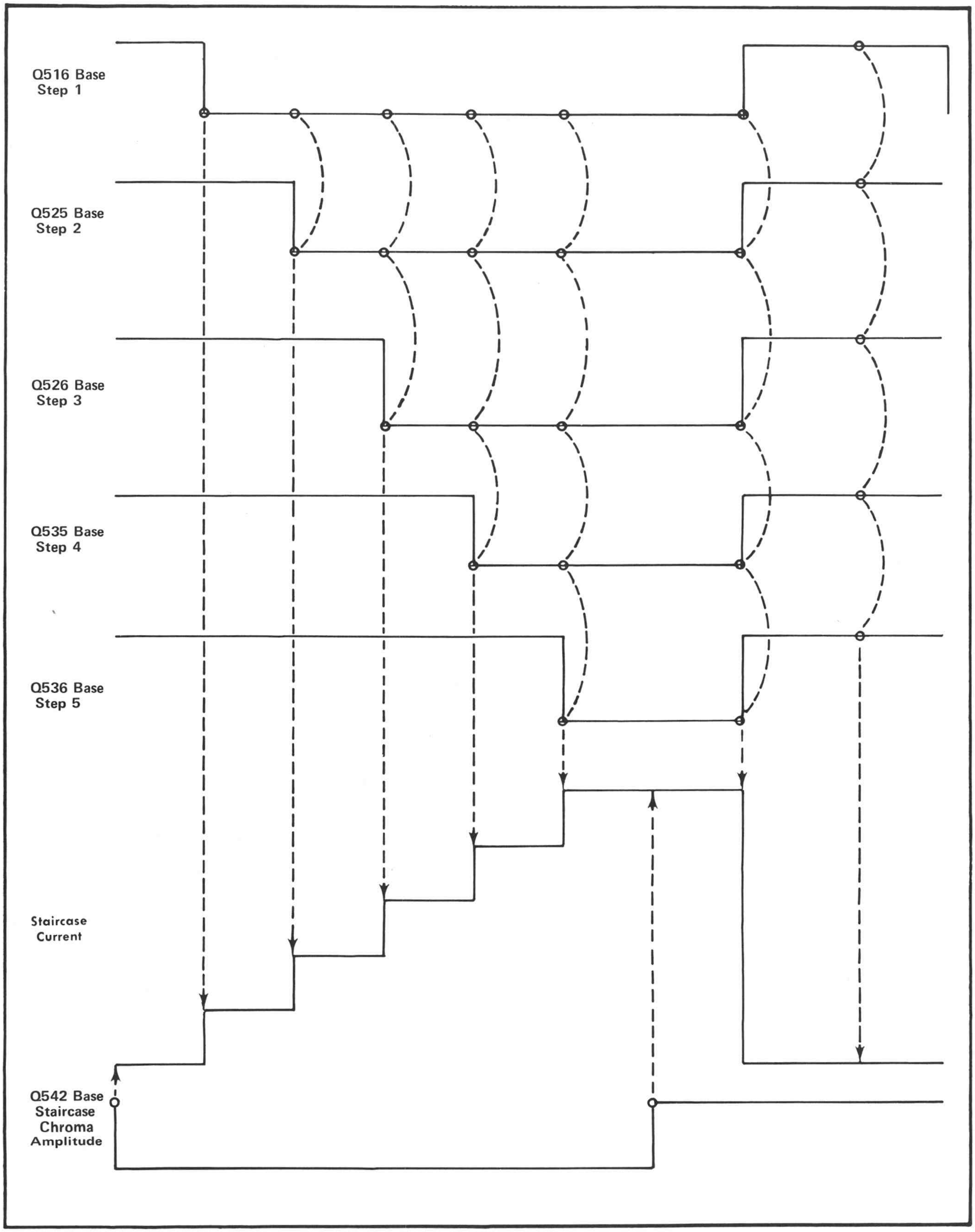


Fig. 3-15. Driving signals into Staircase Luminance Amplitude stages and resulting staircase current waveform at common collector output. Lower waveform shows time-relation of Staircase Chroma Amplitude gating signal.

A negative gate from the Staircase Timing Logic circuit is coupled to the base of Q542, diverting the current from R551 and R561 through Q532.

When the U SUBCARRIER switch is in the "off" position (down), the common emitter current flows through CR542 and R542 to the +3.6 V supply. When the switch is in the "on" position (up), the staircase field drive signal at pin connector AK reverse-biases CR542, permitting the current to be diverted through Q532 during the gate.

The magnitude of the current is set by R561. The output current flows through R541 to pin connector AJ and thence to the +U Filter and Modulator. See Fig. 3-15 for relation of staircase chrominance steps.

APL Chroma

The APL Chroma circuit consists of Q501, Q502, Q503, Q511, Q512, Q513, Q522 and Q531.

This circuit is similar to Staircase Chroma Amplitude and APL Luminance Amplitude previously described.

In the OFF position of the V SUBCARRIER switch, current from R501 flows through CR511 and R512 to the +3.6 V supply and current from R502 and R504 flows through CR513 and CR522 and through R522 to the +3.6 V supply.

When the V SUBCARRIER switch is set to UNMOD, presence of the APL Field Drive signal at pin connector AE reverse biases CR511 for the duration of the negative gate. This permits current flow through Q511, providing a low-level offset chrominance during the APL lines.

When the V SUBCARRIER switch is set to MOD, presence of the APL Field Drive signal (negative gate) at pin connector AF reverse biases CR513 and CR522, permitting current flow through Q531 and Q522. Signals from the Staircase Timing Logic circuit divert current from Q503 and Q513 to Q531, while other Staircase Timing Logic signals divert current from Q502 and Q512 to Q522. Simultaneously, the negative gate at pin connector AF reverse biases CR521, changing the voltage division across the divider consisting of R512, CR510 and R521. This results in CR511 being reverse biased, permitting current flow through Q511.

Fig. 3-16 shows the time relation between the input gates, the output waveform of APL Chroma and the video output waveform.

Comp Sync Amplitude

Q544 and Q546 comprise the Comp Sync Amplitude circuit. This circuit is a current switch pair, similar to APL Luminance Amplitude, etc.

The composite sync signal at pin connector T is negative-going and diverts the current from Q546 to Q544. R567 sets the magnitude of the signal current. The adjusted signal is coupled through R544 to pin connector AM. When this signal is turned off, the current flows through Q546 continuously, diverting all current away from Q544. This maintains the output blanking level at 0 V instead of shifting it to sync tip voltage.

COLOR BAR DRIVE 4a

Color Bar Chroma Amplitude

The Color Bar Chroma Amplitude circuit consists of Q400, Q402, Q403, Q406, Q407, Q408, Q420, Q422, Q423, Q426, Q427 and Q428. In this circuit, the amplitudes of the red, green and blue components of the ± V and ± U signals are adjusted to industry standards.

The circuit consists of 6 similar stages. Each of the three colors has an individual switching stage for the U component and a stage for the V component.

Since the stages are all similar, the blue amplitude-setting stage for the +U signal will be described as an example.

The blue chrominance drive signal from the Color Bar Chroma Counter and Logic circuit is coupled to pin connector S and thence to the base of Q428. The signal is negative in polarity, driving Q428 into cutoff during each pulse. The current that had been flowing from R418 and R419 through Q428 is now diverted to flow through Q408 and R409. R419 is adjustable, permitting calibration of the +U signal magnitude. The signal is coupled through R409 (a parasitic suppressor) to pin connector AB and thence to the U Filter.

When the front-panel COLOR BAR AMPL switch is set to 75%, the Color Bar Voltage Supply is at −10.2 V. The emitter circuit of Q428 and Q408 is therefore returned through R418 and R419 to −10.2 V, which sets the current through this divider to correspond to 75% amplitude. The 0.6 V supply temperature compensates the Vbe of Q408.

When the COLOR BAR AMPL switch is set to 100%, the Color Bar Supply Voltage becomes −13.5 V, thus increasing the current through R418 and R419 to correspond to 100% amplitude.

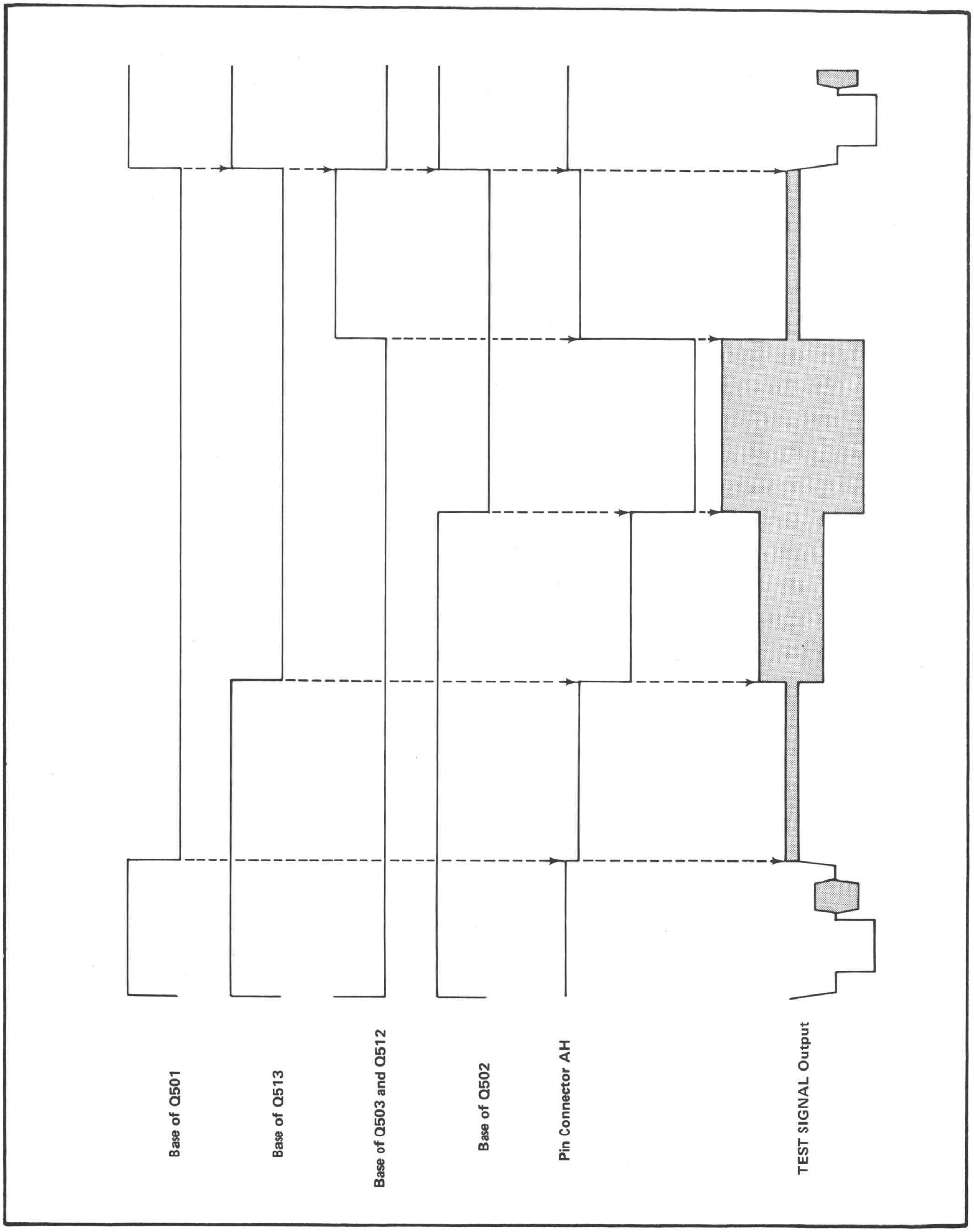


Fig. 3-16. Input and output waveforms for the APL Chroma circuit shown in relation to TEST SIGNAL output.

R428 and C427 introduce a signal delay to permit time-coincidence adjustment of the +U signal to the —U signal.

With the COLOR BAR U switch in the upper position, the drive to pin connector M is a positive gate during the vertical blanking interval. This gate causes CR406 to be forward biased, diverting the blue channel current through CR406 and R427. During the active video portion of the field, the Color Bar Full Field Drive signal at pin connector M is at nearly ground potential, reverse-biasing CR406 and permitting the blue chrominance amplitude signal to flow through Q408.

When the COLOR BAR U switch is set to SPLIT FIELD (center), the Color Bar Split Field Drive signal is coupled to pin connector M. This signal is a positive gate which diverts the blue channel current through CR406 and R427 during the last 60 lines in each field and during the vertical blanking interval. The blue chrominance signal flows through Q408 for the remaining active video lines.

From pin connector S, the blue chroma drive signal is also coupled to the base of Q420 and thence through a circuit similar to that just described to form the —V component of the blue chroma amplitude signal.

U Burst Amplitude

Q404, Q424 and CR425 comprise the U Burst Amplitude circuit. This circuit consists of a switching pair stage which is very similar to the Color Bar Chroma Amplitude stage previously described.

The Burst Flag (a negative gate) at pin connector N is coupled to the base of Q424, thus diverting the current that had been flowing through Q424 to flow through Q404. R414 calibrates the U burst amplitude via the magnitude of the current which flows through Q404. The signal current is then coupled through R408 (a parasitic suppressor) to pin connector AA to form part of the —U signal.

When the front-panel U BURST switch is in the "off" position (down), the U burst signal current is diverted through CR425 to the +3.6 V supply.

MODULATOR ⟨1⟩

Subcarrier Limiter & Modulator Driver

Q114 through Q118 comprise the Subcarrier Limiter and Modulator Driver circuit. This circuit serves to assure that the modulator is always driven with the same amplitude of subcarrier signal, whether the subcarrier is supplied from an internal or external source. Also, the circuit corrects for any lack of symmetry in the input waveform to assure that the modulator is driven with a balanced input waveform.

The input stage, Q114 with diodes CR104 and CR105, limits the peak-to-peak amplitude at the collector of Q114 to approximately 1.1 volts. CR104 limits the positive excursions and CR105 limits the negative excursions.

The subcarrier signal, now roughly square wave in shape, is coupled through C105 to the base of Q115. Q115 and Q116 convert the signal into a push-pull signal by common-emitter coupling. C115/R106 and C116/R116 integrate the input square wave, changing the wave-shape to triangular. The triangular-shaped signal is AC coupled through C117 and C118, resulting in a drive signal which is symmetrical in duty cycle. In other words, the duration of the positive and negative excursions (from 0 volts) is equal.

The amplitude of the triangular signal at the bases of Q117 and Q118 is sufficient to drive each side to cutoff and saturation, causing a square wave signal across the input windings of T127. The square wave frequency is at the subcarrier rate.

0°—180° Phase Shifter

The 0°-180° Phase Shifter circuit includes U102, Q111, Q112, Q113, Q122, and Q123. This circuit provides selection of the phase of the V component.

U102 is connected as a JK Flip-Flop and is triggered by the trailing edge of the inverted Bar Preset signal (via Q113) at the line rate. The flip-flop is preset by the PAL Pulse signal at pin connector AK.

When the V AXIS PHASING switch is set to 90°/270° (normal), U102 is triggered into opposite states (alternately) at the line rate. When the switch is set to 90°, +3.6 V is applied to pin 3 of U102, allowing the flip-flop to be triggered into only the pin 5 high-pin 7 low state. When the switch is set to 270°, the flip-flop is allowed to be triggered only to the opposite state, with pin 5 low and pin 7 high.

Q111 and Q112 serve as push-pull drivers for Q122 and Q123, which, in turn, drive the primary of T144. For any given line, one side (for example Q122) will be in saturation while the other side (Q123) is cut off. No collector supply as such is required for Q122 and Q123 since sufficient base drive is available for the transistors to function in reverse. That is, the collector acts as an emitter and vice versa.

U-V Quad Phase

The subcarrier signal is coupled from T127 through the U-V Quad Phase, C127, L126 and C125 and through C124 to the center tap on T144. In passing through the U-V Quad Phase circuit, the subcarrier signal is shifted 90° in phase.

During a line where Q122 is in saturation (270° the subcarrier signal current flows through half of T144 primary and Q122. When Q123 is in saturation (90° phase), the subcarrier signal current flows through the other half of T144 in the opposite direction and through Q123. Therefore, when the V AXIS PHASING switch is set to 90°/270° the subcarrier signal appearing across the secondary of T144 is shifted 180° in phase each line.

± U and ± V Filters

L183, C182 and C193 comprise the +V Filter. The −V Filter consists of L163, C162 and C173.

The characteristics of the two filters must be made identical since the composite V signal is formed after the filters in differential stage, Q153A & B. Separate handling of the + and − V components is required in order to achieve the excellent carrier balance stability of the Type 142.

Bandwidth of each filter is approximately 1.5 MHz, preventing the V components from exceeding the 3.58 MHz modulated frequency. The +U Filter, L187 and the −U Filter, L167 are identical in operation to the V filters.

When the front-panel controls are set to provide a full field color bar signal for composite video, the +blue signal component is coupled to pin connector O to become the +U component. The −red, green and burst components at pin connector P form the −U component. At pin connector B the −blue and green signals form the −V component and the +red signal at pin connector H forms the +V component.

When a modulated staircase signal is selected, other modulating signals are coupled in as indicated to form the U and V components.

U and V Double Balanced Modulators

Except for the phase-shifting of the V axis with respect to the U axis, the two modulators are identical in operation. A description of the U Modulator will be given as an example.

The U Modulator circuit consists of Q146, Q156, Q157A, Q157B, Q166, Q176, Q177 and Q178.

The modulator stage, Q146, Q156, Q166 and Q176 is connected in a double-balanced configuration. This type of modulator cancels out the modulated carrier and the modulating signal, retaining the sidebands.

The subcarrier signal (3.58 MHz) across the secondary of T136 drives the bases of Q146, Q156, Q166 and Q176. Q157A and Q157B provide a differential signal current to the emitters of the modulator stage depending on the drive conditions. For example, if a +phase signal is required, a negative signal current is delivered through the +U Filter and its terminating grounded base stage (Q177) to the 1 kΩ load of R168. This develops a negative voltage at the base of Q157A, decreasing its collector current while increasing Q157B's collector current, since a near-constant current is delivered to the junction of R157 and R167 through R143.

Q166 and Q176 switch the current from Q157A alternately from one end of T174 to the other at a 3.58 MHz rate, thus developing a 3.58 MHz square wave across the reflected load of R174.

Q146 and Q156 switch the current from Q157B alternately from one end of T174 to the other also, but 180° out of phase with the current delivered by Q157A. Thus, if the currents from Q157A and Q157B are equal, the current square waves in T174 will cancel. If Q157B delivers a greater current than Q157A, the signal developed across T174 will be proportional to the current difference and positive in polarity; that is, 0° in phase.

R148 and C157 balance the plus and minus U driver stages to minimize any residual subcarrier component. These are adjusted for minimum chrominance output when V and U are turned off (see Performance Check/Calibration section).

Bandpass Filter

The modulated output appears across T174 and is coupled through the Bandpass Filter, L176 and L184, via a short length of 50 Ω coaxial cable which also serves as a low pass filter to the Chroma Output Amplifier.

The Bandpass Filter has an arithmetically symmetrical response with a center frequency of 3.58 MHz. Bandpass of the filter is approximately 1.5 MHz.

This bandwidth in conjunction with the 1.5 MHz V and U filters provides a chrominance bandwidth of approximately ±1 MHz.

VIDEO OUT 4b

The Video Out diagram contains several circuits which will be individually described. These circuits include the Color Bar Luminance Amplitude, Wide Band Filter, Narrow Band Filter, Luminance Output Amplifier, Chrominance Enable and Chrominance Output Amplifier.

Color Bar Luminance Amplitude

The Color Bar Luminance Amplitude circuit includes Q434, Q436, Q441, Q443, Q445, Q450 through Q456, Q463 and Q465.

The red, blue and green amplitude-setting stages, white reference and setup level stages are all similar in operation, so a description of the green amplitude-setting stage will serve as an example.

The green luminance signal (negative polarity) is coupled from pin connector AS to the base of Q463, turning Q463 off and diverting the current through Q465. Amplitude of the current is determined by the setting of R454. C465 compensates for unequal delays in the rise and fall of the signal.

When the front-panel Y switch is set to the off position (down), the signal current is shunted to the +3.6 V supply through CR462, R452 and R462. With the Y switch set to 'on' (up), the color bar full field drive signal (delayed by R452 and C452 to match the chroma delay) appearing at pin connector AT reverse biases CR462, permitting the normal signal current to flow through Q465. During the vertical blanking interval, (except during a color bar VITS signal) CR462 is forward biased, diverting the signal current to the +3.6 V supply.

The additional current for the 100% WHITE REF supplied by R443 and R455, is diverted through Q455 to become signal current only when the following conditions are satisfied: (1) Q453 must be off (2) Q451 must be off (3) Q452 must be off and (4) the white drive via the WHITE REF, 75% AMPL and Y switches must be present. R443 adjusts the current to the proper white reference amplitude. Currents from the red, blue and green amplitude stages, white reference amplitude and setup amplitude stages are coupled together through R456 to the emitter of Q446.

When the front-panel AMPL switch is set to 75%, the color bar voltage (CBV) in the emitter circuits of the red, blue, green and white reference amplitude stages is set to −10.2 V. With the AMPL switch set to 100%, the color bar voltage is changed to −13.5 V, increasing the emitter currents to correspond to 100% amplitude.

The composite sync signal is coupled from pin connector H to the emitter of Q446, and along with the color bar luminance amplitude signals, is coupled through the Wide Band Filter.

Wide Band Filter

The color bar luminance levels and composite sync signal are coupled through Q446 to the Wide Band Filter, L456 and L466. The output impedance of Q446 is high, serving as a constant-current signal source to drive the filter. R457 is the termination for the filter. The filter has a risetime of 115 ns and is $\sin^2$ shaped.

Response of the wide band filter has been selected to provide color bar luminance steps extending to the allowable system bandwidth.

Narrow Band Filter

The APL luminance and staircase luminance signals are coupled through Q447 to the Narrow Band Filter, L458 and L468. The filter has a risetime of 260 ns and is $\sin^2$ shaped. The function of the filter is to minimize step harmonics which may fall in the chrominance band.

Luminance Output Amplifier

The Luminance Output Amplifier, consisting of Q476, Q477, Q478 and Q487, is an operational amplifier circuit. Characteristically, the input impedance is very low and the signalxvoltage at the emitter of Q478 will be only a few millivolts in amplitude.

R_f for the amplifier consists of R467 and R499. Adjustment of R499 sets the gain of the stage, providing a calibrated luminance amplitude at the output connector.

R478 provides adjustment of the DC input current thus determining the output DC level.

Q476 sets the emitter voltage of Q477 and acts as a temperature compensation. CR479 in the base circuit of Q478 is also a temperature compensation.

The amplified luminance signal is coupled through R488 and R497 to the rear- and front-panel TEST SIGNAL connectors.

K495 connects the output signals from the luminance and chrominance output amplifiers to the output connectors when the instrument is energized. When the instrument

is turned off, contacts on K495 remove the connections between the output amplifiers and the output connectors and then connect the output connectors through R487 and R496 to ground. This assures that any cables connected to the output connectors are terminated in 75 ohms whether the instrument is turned on or off.

Chrominance Enable

The Chrominance Enable circuit includes Q471, Q481 and Q491. When a subcarrier signal is present at the subcarrier output amplifier, the signal is detected by CR1156 (on the Subcarrier Osc. & Output Amplifier diagram), resulting in a negative voltage at pin connector AW and the base of Q471. This negative voltage forward biases Q471 into saturation. With Q471 in saturation, the divider consisting of R461, R471 and R491 reverse biases Q481. Q491 is then reverse biased through R490, so no subcarrier signal current can flow through C491 and Q491 to ground. C491 is a 3-volt capacitor which supplies leakage current to maintain the collector-base junction of Q491 in a reverse bias condition.

When there is no subcarrier signal present at the subcarrier output amplifier, the voltage at pin connector AW is near zero and Q471 is cut off. Q481 becomes forward biased, which causes Q491 to go into saturation. With Q491 in saturation, any signal (noise) at pin connector BE is shunted to ground through C491 and Q491.

Chrominance Output Amplifier

The Chrominance Output Amplifier is an operational amplifier consisting of Q473, Q474, Q475 and Q484. This circuit is very similar to the Luminance Output Amplifier previously described.

The chrominance signal at pin connector BE is coupled to the emitter of Q473 through R481, which serves as R_i for the amplifier. R_f consists of R473 and R482. Adjustment of R482 sets the gain of the stage to provide a calibrated chrominance amplitude at the output connectors.

Luminance and chrominance signals are combined into a composite signal at the output connectors. The parallel combinations R488/R494 and R495/R497 each provide an output impedance of 75 Ω at each respective output connector.

Separate output amplifiers for luminance and chrominance are used in order to minimize distortions such as differential phase and differential gain. If a common output amplifier were used, changes in the luminance signal could cause changes in the instantaneous operating level of the amplifier stages, introducing differential distortion to the chrominance signal.

OUTPUT AMPLIFIERS ⟨9⟩

The Output Amps board contains the output amplifiers for the COMP BLANKING, COMP SYNC, VERTICAL DRIVE, PAL PULSE and BURST FLAG signals available at front and rear panel connectors.

These five amplifiers are nearly identical in operation, making it possible to use one which is working properly as a reference when trouble-shooting another which is defective.

A description of the PAL Pulse Output Amp follows. This description may be used to gain an understanding of the operation of the other four amplifiers.

PAL PULSE Output Amp

The PAL Pulse Output Amp includes Q980, Q982, Q990, Q992, Q994, Q996 and Q998.

The PAL Pulse signal from the Int PAL Pulse Logic circuit is coupled to pin connector AE, and through R982 (a VHF oscillation suppressor) to the base of Q982. At pin connector AE, the PAL Pulse signal is positive in polarity with an excursion from approximately 0 V to +2 V.

Q980 and Q982 operate as a switch pair. The positive signal at the base of Q982 drives Q982 into cutoff, diverting the current flowing in R981 through Q980.

The relatively high output impedance of Q980 serves as a constant current source to drive the filter, L984 and L985. The filter limits the risetime of the composite blanking signal to prevent ringing in transmission cables.

Q990, Q992, Q994, Q996 and Q998 form an operational amplifier. R990 is the feedback resistance. The input current is determined by R981. Q996 and Q998 are parallel-connected to supply the negative-going drive to the two PAL PULSE outputs. Q994, an NPN, provides current for reverse terminating any negative pulses which may appear at the output terminal due to unterminated coaxial cables.

R992, R993, R994, C992 and C994 automatically set the current in Q994 and Q996 at approximately 2 mA, while allowing the amplifier to deliver a positive pulse current of approximately 50 mA.

Q964 is common to all five output amplifiers, supplying temperature-compensated base bias for Q900, Q920, Q940, Q960 and Q980.

CROSSHATCH and DOT GENERATOR 7

The Crosshatch and Dot generator circuit develops the CONVERGENCE PATTERN output signal. The diagram shows 3 basically separate circuits, the horizontal and field generators and output amplifier.

Horizontal Timing Generator

The Horizontal Generator includes Q751, Q752, Q761, Q762, Q776, Q783, Q786, Q703, Q794, Q796, U775, U785, U785A, and U785B.

During horizontal unblanking time, Q761 is biased off and its collector is at a positive level determined by the temperature compensated constant current from Q751 through the HORIZONTAL POSITION control. C761 is charged to this level.

Upon arrival of the positive-going line blanking signal at its base, Q761 saturates, reverse biasing Q762 with the preset voltage on C761. Q752 is a constant-current source which discharges C761 at a linear rate. Q762 turns on when the voltage on C761 reaches its Vbe. Therefore, the HORIZONTAL POSITION control setting determines how long Q762 is cut off after the arrival of the line blanking signal. CR762 prevents Q762 from reaching saturation during conduction, so that turn-off is rapid.

With Q762 biased off its collector goes positive, forward biasing Q793. Q793 and R793 present a low impedance shunt across the oscillator tank (L791 and C792), which prevents oscillation, while setting the proper current through L791 for an instant start of oscillation.

When the positive gate of the collector of Q762 ends, Q793 becomes reverse-biased, eliminating the oscillator tank shunt loading. Oscillation commences, with sustaining feedback coupled through Q794 to the base of Q783. CR781 limits the magnitude of the negative excursions at the output of the oscillator tank. CR791 serves as a temperature compensation for the circuit.

The duration of the positive gate from Q762's collector is always less then the period of line blanking, so that the oscillation commences before the end of line blanking. When oscillation starts, vertical crosshatch lines or dots are generated. Since the HORIZ POSITION control setting determines when the oscillation starts with relation to line blanking, this will also determine the horizontal position of the crosshatch lines or dots during the active part of the television line.

Q784 and Q794 are connected as a switch, with the emitter currents flowing through R794. R764 and C783 form a decoupling network for the +10 V supply. During the negative half-cycle of oscillation, current is increased through Q794 shutting off Q784. During the positive half-cycle of oscillation, Q784 is conducting while Q794 is off. At the collector of Q784, the signal is basically a square wave in shape, with the negative-going excursions serving as a trigger signal for U775.

U775 is connected as a preset triggered counter stage. The counter is preset by the positive gate at the collector of Q762. This gate is coupled through R772 to pin 6 of U775. The counter divides the input trigger rate by two. That is, the output signal at pin 5 or 7 is at one-half the input trigger rate at pin 2. The pin 5 output signal is coupled to U785A to develop the horizontal timing component of the dot pattern. The negative gate at pin 5 is also coupled back through R754 to the base of Q784, lengthening the time during which pin 5 is held low. The output signals at pins 5 and 7 are non-symmetrical, with the negative gate at pin 5 longer in duration than the negative gate at pin 7. This difference is necessary to achieve proper interlace of dots and crosshatch signals when operating the BOTH position of the DISPLAY switch.

C764 and R774 (base of Q784) provide a time-constant which prevents the leading edge of the positive gate from pin 5 of U775 from initiating a double trigger.

With the DISPLAY switch set to BOTH, the negative gate at pin 5 of U775 is inverted by U785A. The resulting positive gate is differentiated by C785 and R765, giving a narrow positive spike at the base of Q786. This spike reverse-biases Q786 for 350 ns, providing a negative pulse at the collector and TP766.

The negative gate at pin 7 of U775 is inverted by U785B, resulting in a positive gate at the base of Q796. The positive gate thus appearing at the emitter of Q796 is differentiated by C795 and R775. The 250 ns positive pulse is coupled through Q776, a grounded base stage to TP776.

Refer to Fig. 3-17 for time-related waveforms in the Horizontal Generator.

When the DISPLAY switch is set to CROSSHATCH, +3.6 V is coupled to pin 1 of U785A, preventing generation of the dot pattern. In the DOT position of the DISPLAY

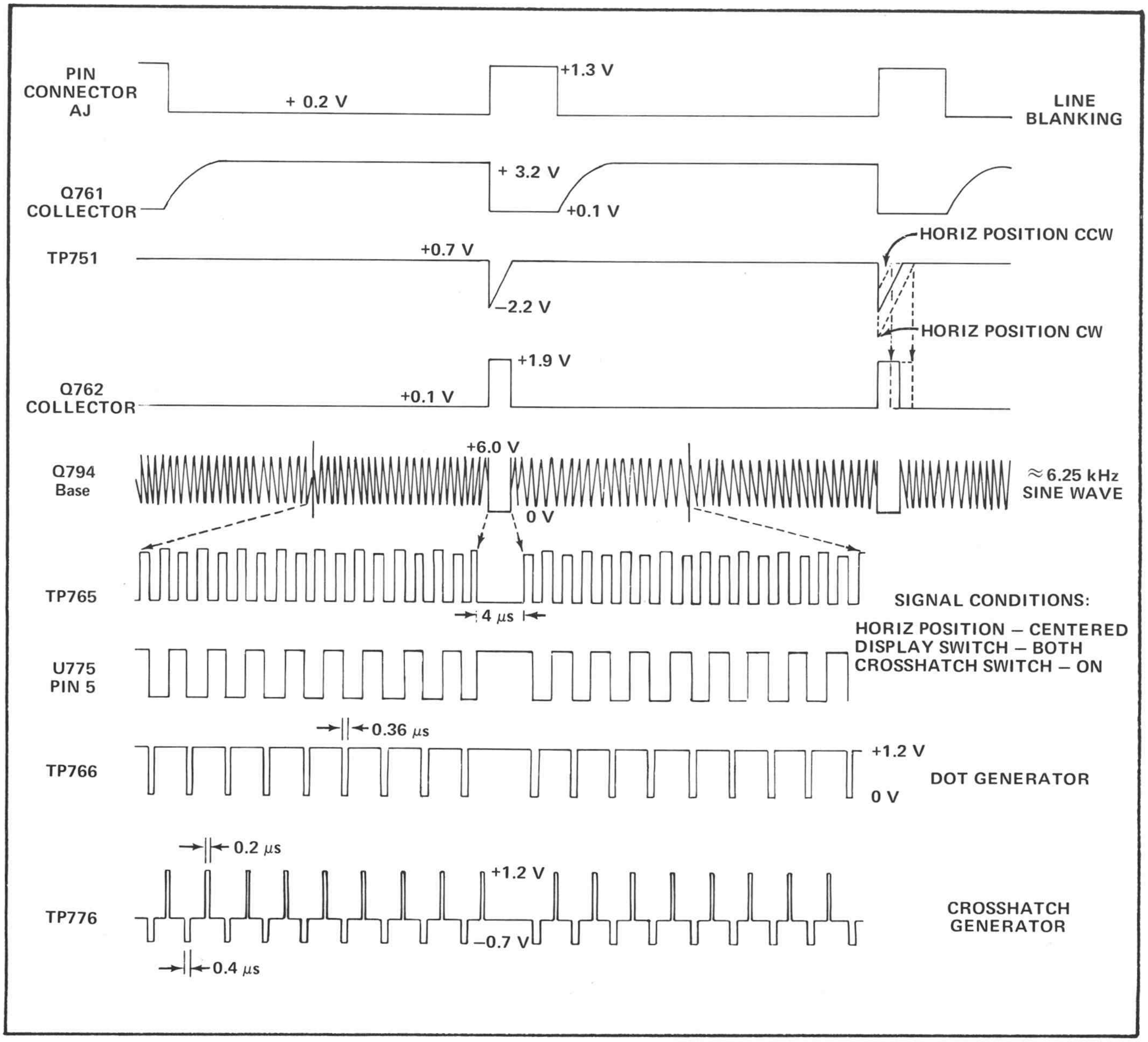


Fig. 3-17. Time-related sequential waveforms in the Vertical Generator of the Crosshatch and Dot Generator. Time scale of bottom 4 waveforms is 2 times the rate of the others.

switch, +3.6 V is coupled through CR784 to pin 5 of U785B, preventing generation of the vertical crosshatch component, +3.6 V is also coupled through CR794 to pin 3 of U732, preventing generation of the horizontal crosshatch component.

The CROSSHATCH switch disables the horizontal crosshatch generator when set to VERT by coupling +3.6 V to pin 3 of U732. In the HORIZ position, +3.6 V is coupled to pin 5 of U785B, disabling the vertical crosshatch generator.

Field Timing Generator

The Field Timing Generator includes Q704, Q705, Q714, Q715, U711, U712, U721 through U725, U731, U734, U741, U742, U743A, and U744.

The circuit is basically a counter which counts down from the line blanking signal at a ratio of 35:1. The counter is preset by a positive gate which is initiated by the vertical blanking signal. Width of the preset gate is determined by the setting of the VERT POSITION control.

The vertical blanking signal at pin connector Y is a positive gate to the base of Q714. The VERT POSITION circuit is very much like the HORIZ POSITION circuit previously described under Horizontal Generator Timing. A negative sawtooth appears at the base of Q715, with the sawtooth determined by the setting of the VERT POSITION control. Q715 is cut off during the sawtooth, resulting in a positive gate at the collector. R707 and C716 are a speed-up circuit which lowers the emitter impedance of Q705 for a short time when the leading edge of the sawtooth appears at the collector. This permits the collector to fall rapidly.

The positive gate from Q715 is coupled directly to pin 6 of U721 and U724 and through U725 to pin 6 of U722, U723, U731, and U734 to serve as a preset signal. The counter is locked in the preset condition for the duration of this preset gate. U722, U723, U731, and U734 are also preset each time pin 5 of U724 goes high, causing a countdown of 35:1.

U711 is a divide-by-2 counter, triggered from the trailing edge of the vertical blanking signal to allow the 35-state counter to be preset only every other field. This insures proper interlacing of the convergence pattern (see Fig. 3-18).

To shift the display one line when the VERT POSITION control is rotated, it is necessary that the preset pulse to the 32-state counter occur in the opposite field. U712B determines the field to which the preset pulse occurs. This is accomplished as follows: the preset pulse appearing at the output of Q715 is differentiated by R711 and C712. The differentiated pulse is applied to pin 3 of U712B. The gate is open only if the 15,734 Hz signal to pin 5 is negative at the same instant the negative spike appears at pin 3. If the gate opens, a preset to U711 causes this flip-flop to change states. When the flip-flop changes states, one count is added and a field change occurs. CR703 and C702 insure that the gate of U712B is open less than 50% of the time for the 15,734 Hz signal. This gives the system a hysteresis, thereby making the flip-flop favor its present state. The action of U712B can best be described as a vernier vertical position control.

To produce crosshatch (a pattern display with lines and dots centered with respect to each other), to minimize flicker, and to maintain standards, 15 horizontal rows of lines and dots must be generated (35:525). U721, U722, U723, U724, U731, U734, and U741A are the stages of the 35-state counter, used for generating timing signals necessary to insure the above-listed conditions. The counter is triggered by the trailing edge of the line blanking signal at pin 2 of U731. Refer to Fig. 3-19 for the time-related waveforms of the counter.

U732, U733, U735B, U741B, U742, U743B, and U744 are the logic stages required to combine the timing signals from the 35-state counter to produce the proper interlace of the convergence signals. Line logic is obtained from U742 and U744, while U735B and U733 are the dot logic stages. Referring to Fig. 3-18 and Fig. 3-19, it can be seen that three field lines are required to produce one dot and that two field lines are needed for one line. Only after one complete frame will the complete dots and lines be formed. Dot and line interlacing logic information is also given in Fig. 3-19 by a series of dashed lines from the input signals to the output signals. U735A, U743A, and U745 comprise the field line and dot pulse combination logic circuitry. Timing gates from the various integrated circuits of the Timing gates from the various integrated circuits of the Field Timing Generator and the line and dot pulse information from the Horizontal Timing Generator circuits are combined to produce the crosshatch drive to the output.

Output Amplifier

The Output Amplifier includes Q728, Q737, Q738, Q739, Q787, Q788, Q789, Q797, Q798, and Q799. Q787, Q788, Q789, Q797, Q798, and Q799 perform the current-switching necessary to combine the composite blanking, composite sync, and the convergence pattern information to form the complete convergence pattern signal. This convergence pattern current then drives the filter, L768 and L769.

The filter has a sine-squared response with a risetime of 115 ns, which prevents ringing in transmission cables connected to the output connectors. The filter is terminated by R759 at the emitter of Q739.

Q728, Q737, Q738, and Q739 form an operational amplifier. Characteristically, the input impedance is very low and the signal voltage at the emitter of Q739 will be only a few millivolts. R_f for the amplifier consists of R729 and R739. Adjustment of R729 sets the gain of the stage, providing a calibrated amplitude at the output.

Q737 sets the emitter voltage of Q738 and acts as temperature compensation. CR749 in the base circuit of Q739 is also temperature compensation.

The amplified convergence signal is coupled through R718 and R719 for use at the front- and rear-panel CONVERGENCE PATTERN connectors.

PAL LOCK ⟨12⟩

The PAL Lock board contains circuits for generating the PAL Pulse signal, Burst Blanking, Ext Sync Inhibit, and Horiz Drive Output Amplifier.

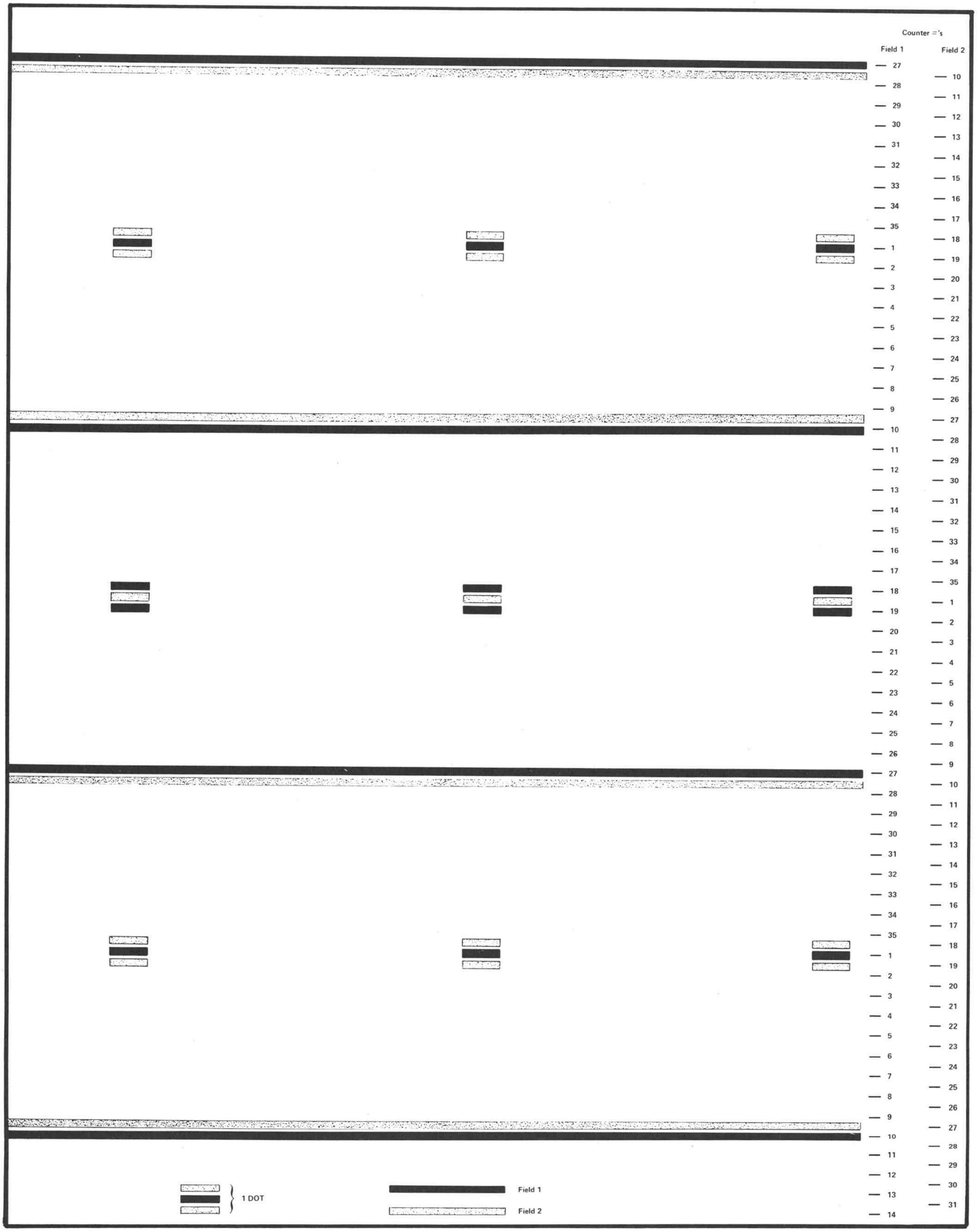


Fig. 3-18. Partial view of convergence interlacing pattern in relation to 35 state counter.

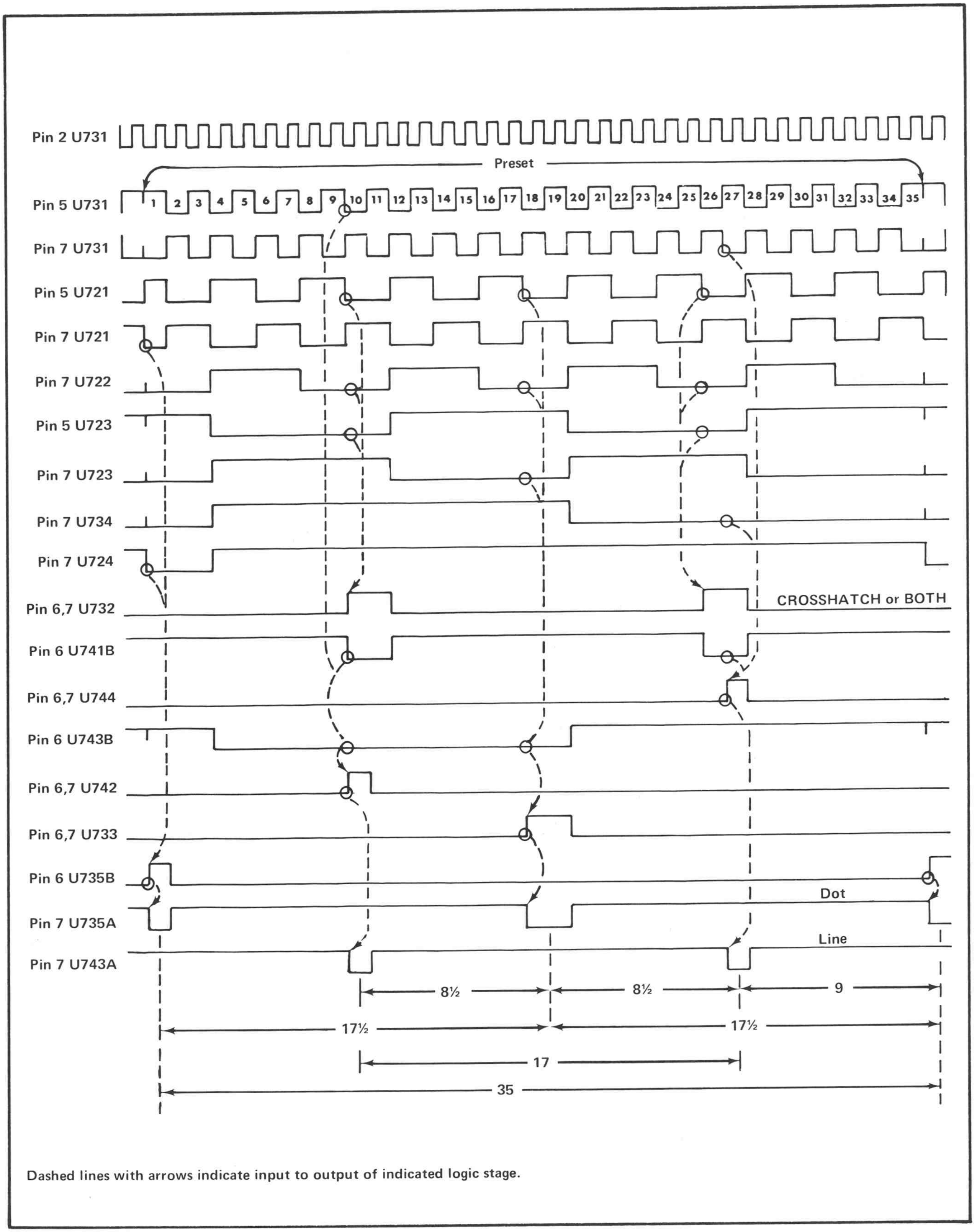


Fig. 3-19. Time-related sequential waveforms in the Field Timing Generator and Logic outputs.

PAL Pulse

The PAL Pulse circuit includes the Buffer, Ext PAL Pulse Drive, Field 1 & 3 Preset Gate, PAL Preset Gate, Coincidence Gate, Int PAL Pulse Gate, and Int PAL Pulse Logic stages.

If an external sync source is applied to the Type 142, a vertical preset signal is coupled from pin connector AJ through U1224 (Buffer) to pin 6 of U1223 (PAL Preset Gate). This signal then serves as a preset to synchronize the PAL Pulse with the external sync signal. When an external PAL pulse is applied, this signal is amplified by Q1236 and Q1238 (Ext PAL Pulse Drive), inverted, and coupled to pin 6 of U1223.

U1223 is triggered by the signal from U1213 (Field 1 & 3 Preset Gate), which combines signals from the Field Counter and Field Logic stages to form the negative-going trigger pulse.

The signal generated by U1223 is coupled to the 0°-180° Phase Shifter, Bruch Logic, and Int PAL Pulse Gate (U1211). Connections to the 0°-180° Phase Shifter and Bruch Logic may be interchanged to provide a PAL Pulse signal which starts with lines containing either 135° or 225° burst phase.

The Int PAL Pulse Gate is preset by the signal from the PAL Preset Gate and triggered by the output of the Coincidence Gate (Q1233 and Q1234). The Coincidence Gate combines a composite sync with the horizontal drive signal to develop a negative-going trigger pulse.

The Int PAL Pulse logic stage (U1221A) combines the signal from the Int PAL Pulse Gate with an inverted horizontal drive pulse to form the PAL Pulse signal. The signal is then coupled to the PAL Pulse Output Amplifier via pin connector AF.

Burst Blanking

The Burst Blanking circuit includes Bruch Logic, Bruch Blanking Gate, and Burst Blanking Logic stages.

The Bruch Logic stage consists of U1216B, U1217, U1219 & U1226, Q1204, Q1206 and Q1209. The transistors serve as buffers. U1216B, U1217, U1219, and U1226 are connected as multiple-input AND gates, combining various timing signals from the Field Counter and the output of the PAL Preset Gate to form Set and Reset pulses for the Bruch Blanking Gate (U1227 & U1229).

The Bruch Blanking Gate is a Set-Reset Flip-Flop which is set and reset once for each of the four fields. The output is coupled to the Burst Blanking Logic stage (U1216A).

The Burst Blanking Logic stage is a two-input AND gate, combining a gate pulse from Burst Logic with the Bruch blanking gate. When these signals are combined, a burst blanking signal is generated which blanks burst signals during the vertical blanking interval in accordance with Bruch sequence (4 fields).

If the BURST BLANKING switch is set to NTSC SEQ, the Bruch blanking gate signal is grounded and burst blanking is in accordance with NTSC sequence (2 fields).

The output of the Burst Blanking Logic stage is coupled to the U and V Burst Amplitude stages and through Q1207 to the Burst Flag Output Amplifier.

Ext Sync Inhibit Gate

The Ext Sync Inhibit Gate consists of U1214 connected as a triggered flip-flop with preset input. The preset input (pin 6) is connected to the REF switch. If the REF switch is set to EXT, pin 6 is high and the output (pin 7) is held low. The low is coupled to an AND gate in the Phase Lock Sampler, enabling the Ext Sync Position signal to be coupled to the Phase Lock Sampler. When the REF switch is set to INT, pin 6 drops to ground potential andU1214 is triggered by the 7.8 kHz signal from the Line Counter. The output from U1214 is a 3.9 kHz gate which inhibits operation of the AND gate in the Phase Lock Sampler, blocking the Ext Sync Position signal.

Horiz Drive Output Amplifier

See OUTPUT AMPLIFIERS for description.

LOW VOLTAGE POWER SUPPLY ⟨8⟩

The Low Voltage Power Supply circuit provides the operating power for the Type 142 from three regulated supplies, −15 volts, +3.6 volts and +10 volts, and a +10 volt unregulated supply. Electronic regulation is used to provide stable, low ripple output voltages. All the regulated supplies are current limited to prevent instrument damage in the event that a supply is inadvertently shorted to ground. The primary circuit of the transformer employs voltage and range selector plugs to permit selection of the line voltage operating range.

Power Input

Power is applied to the primary winding of transformer T1 via RFI Filter FL4, the POWER switch S4, 115 volt line fuse F2, Voltage Selector plug S3 and the Range Selector plug S2. The Voltage Selector plug S3 connects the split primaries of T1 in parallel for 115 volt range of operation, or in series for 230 volt range. A second line fuse, F3, is

connected into the circuit when the Voltage Selector plug is placed in the 230 volt position to provide the correct protection for 230 volt operation. The current rating of F3 is approximately one half of F2.

Range Selector plug S2 allows the instrument to regulate properly on higher or lower than normal line voltages. Each half of the primary has taps above and below 115 volt (230 V) point. As the Range Selector plug is moved from LO to M and then to HI, more turns are added to the primary winding. Therefore, whether the primary voltage has increased or decreased, the secondary voltage can be maintained at a nearly constant level (Es = Ep X Ns/Np).

The RFI Filter FL4 serves to prevent external RF interference from appearing across T1 and also prevents signals generated within the Type 142 from being introduced onto the AC line.

−15 Volt Supply

The −15 volt supply provides the reference voltage for the +3.6 volt and +10 volt supplies (see Fig. 3-20). The reference for the −15 volt supply is a 9.1 volt zener VR870.

The output from the secondary winding (terminals X and Y) of T1 is rectified by a full-wave rectifier consisting of CR861 and CR862. The rectified voltage is filtered by C61 and applied through a −15 Volt Series Regulator stage Q85 before being supplied to the load. Series Regulator Q85 and its Driver E.F. (Emitter Follower) Q880 are controlled by a Voltage Comparator consisting of Q875 and Q876 with associated components.

The base of Q875 in the Voltage Compartor stage is referenced by a 9.1-volt temperature-compensated zener diode, VR870. The voltage on the base of Q876 is determined by a divider network consisting of R885, −15 volts control R886 and resistor R887. Variable resistor R886 adjusts the base voltage of Q876 so the output voltage of this supply is −15 volts within a tolerance of 3%. The collector potential of Q875 is applied to Driver circuit Q880; this circuit controls Q85, connected as a series regulator.

Assume that the −15 volt supply tends to go in the positive direction (toward −14 volts). This positive-going voltage change is applied to the base of Q876, increasing the current through Q876. The increased current through Q876 decreases the conduction of Q875 and causes the voltage change at the collector of Q875 to be positive-going. This positive-going voltage change is applied to the base of Q880, causing the current through Q880 to increase. The increased current through Q880 causes a positive-going voltage change to occur at its emitter, and this change is applied to the base of Q85. Transistor Q85 increases its conduction. This increased conduction through Q85 effectively decreases its internal resistance and voltage drop, thus increasing the available voltage to the −15 volt supply to offset the original tendency for the supply to go toward −14 volts. Filter capacitor C885 suppresses sudden load changes that fall outside the bandwidth of the regulator circuit.

Network R880 and C880 suppresses any tendency for the Voltage Comparator stage to oscillate. C871 filters out any noise generated by VR870.

Q860 with associated components is an overload protection circuit. This transistor is normally cut off. However, if the −15 volt supply load current is excessive, current through R861 forward biases Q860. The collector current from Q860 flows through R816 (in the +10 volt supply) and causes the base of Q830 to go in the negative direction. The emitter of Q830 follows the base, pulling the base of Q35 down and shutting down the +10 volt supply.

The negative-going voltage change at the emitter of Q830 also appears across R831 and is coupled through R875 and C875 to the base of Q880. The emitter of Q880 follows this change, pulling down the base of Q85 which shuts down the −15 volt supply.

Notice, from this description, that an overload on the −15 volt supply causes both the +10 volt and −15 volt supplies to shut down.

+3.6 Volt Supply

Full wave rectification for the +3.6 volt supply is provided by CR841 and CR842. The rectified voltage is filtered by C42 and applied to the +3.6 Volt Series Regulator stage Q55 before being applied to the load.

The error sensing divider resistors for the +3.6 volt supply are R855, +3.6 VOLTS control R856, and resistor R857. The −15 volt supply is used as the reference for the divider. Thus, if both the −15 volt and +3.6 volt supplies are operating properly, there should be a constant 18.6 volt difference between these two supplies.

Q845 and Q846 form a comparator circuit with the base of Q845 referenced at ground. When the +3.6 volt and −15 volt supplies are at the proper voltages, the base of Q846 is also at 0 volts. If either supply voltage changes, the comparator (Q845 and Q846) is unbalanced, resulting in an error signal at the base of Q850.

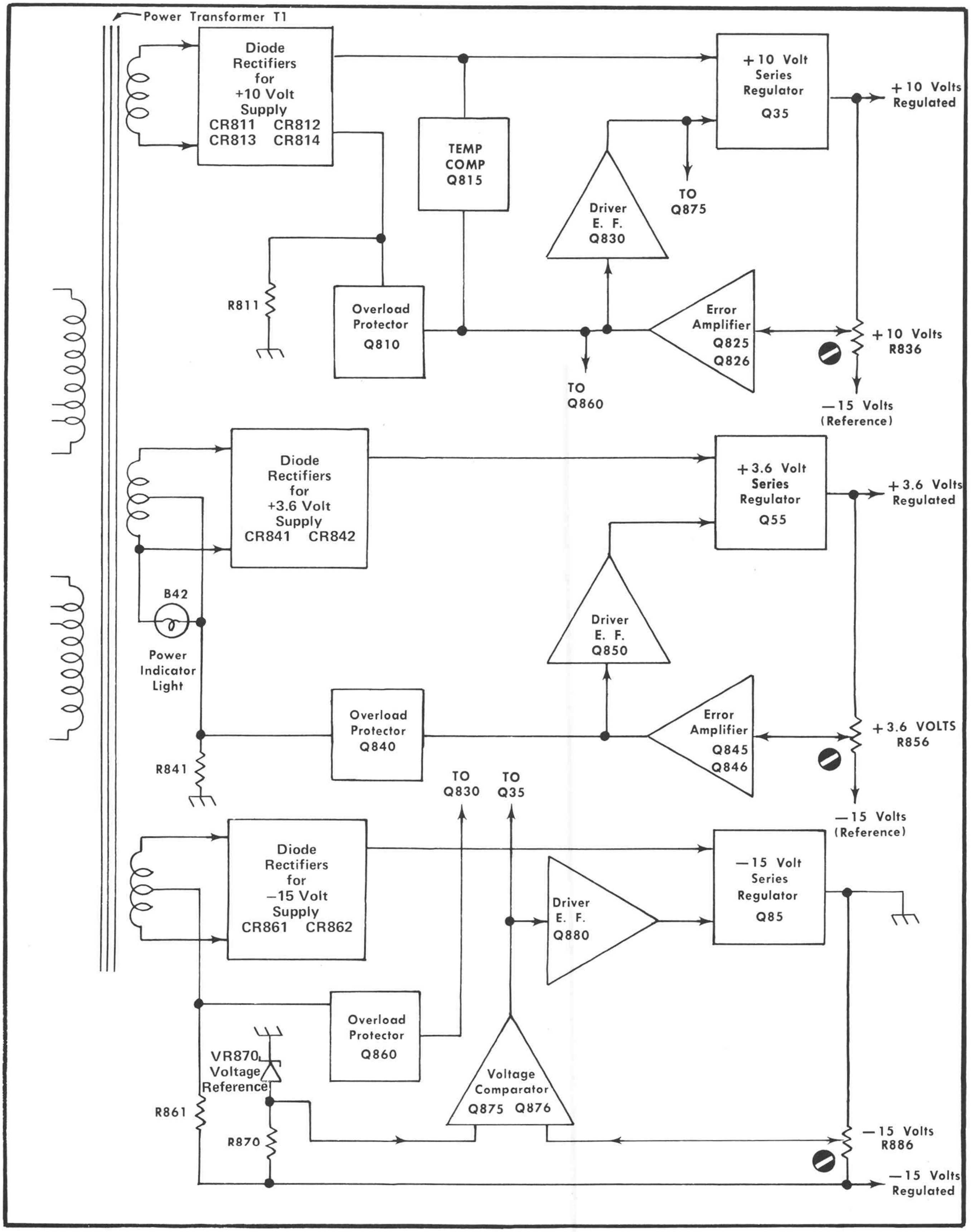


Fig. 3-20. Block diagram of the low-voltage regulated power supplies.

Since Q850 is an emitter follower, the polarity of the error signal is the same at the emitter of Q850 and the base of Q55. The error signal, applied to the base of Q55, is used to control the emitter-to-collector drop across Q55. In this way the output voltage is maintained at its rated value.

For example, if the +3.6 volt supply attempts to rise, the difference voltage across the error sensing divider resistors tends to increase and a fraction of this increase is applied as a positive-going error signal to the base of Q846. At the collector of Q846, the error signal is negative-going and this signal is applied to the base of Q850. The signal is also negative-going at the emitter of Q850, and this signal is applied to the base of Q55. The negative-going signal decreases the current through Q55 and thus increases the voltage drop across Q55 to offset the original tendency for the output voltage to increase.

Variable resistor R856 is the +3.6 VOLTS control to set the output of the supply at +3.6 volts within a tolerance of 3%. Q845 provides temperature compensation for Q846 and clamps the emitter of Q846 at about −0.6 volt. Q840 provides overload protection for the +3.6 volt supply. Q840 is normally in cutoff. If the load current for the supply becomes excessive, Q840 becomes forward biased and a negative-going signal occurs at its collector. This negative-going signal increases the internal resistance of Q55 to limit the current available at the output of the +3.6 volt supply.

Network R850 and C850 prevents the +3.6 volt regulator circuit from oscillating. Operating voltage for the POWER light DS42 is obtained from the connections across one half of T1 secondary winding at pins C and E on the Power Supply circuit board.

+10 Volt Supply

The +10 Volt Supply is similar to the +3.6 Volt Supply. Rectified voltage for the +10 volt supply is provided by the full-wave bridge rectifier consisting of CR811, CR812, CR813 and CR814. The rectified voltage is filtered by C11 and applied to Series Regulator Q35.

The error sensing divider resistors are R835, +10 VOLTS control R836 and resistor R837. The Error Amplifier stage consists of Q825 and Q826 connected as a comparator. The base of Q825 is at ground, and with the +10 volt and the −15 volt supplies at the proper voltages, the base of Q826 will be at 0 volts.

Any change in the +10 volt output will appear at the base of Q826 and will thus be coupled to the base of Q830 as an error signal. This error signal will be coupled to the base of Q835, opposing any tendency for the supply voltage to change.

Q815 serves as a constant current source for Q826. Q810 provides overload protection for the +10 volts supply. If the +10-volt supply load current is excessive, current through R811 forward biases Q810, which shuts down the +10 volt and the −15 volt supplies in the same manner as described for Q860 in the −15 volt supply.

SECTION 4 MAINTENANCE

Change information, if any, affecting this section will be found at the rear of the manual.

Introduction

This section of the manual contains information for use in preventive maintenance, troubleshooting and corrective maintenance of the Type 142.

PREVENTIVE MAINTENANCE

General

Preventive maintenance consists of cleaning, visual inspection and lubrication. Preventive maintenance performed on a regular basis may prevent instrument breakdown and will improve the reliability of this instrument. The severity of the environment to which the Type 142 is subjected determines the frequency of maintenance.

Cleaning

General. The Type 142 should be cleaned as often as operating conditions require. Accumulation of dirt in the instrument can cause overheating and component breakdown. Dirt on components acts as an insulating blanket that prevents efficient heat dissipation. It also provides an electrical conduction path.

CAUTION

Avoid the use of chemical cleaning agents which might damage the plastics used in this instrument. Avoid chemicals which contain benzene, toluene, xylene, acetone or similar solvents.

Exterior. Loose dirt accumulated on the outside of the Type 142 can be removed with a soft cloth or small paint brush. The paint brush is particularly useful for dislodging dirt on and around the front-panel controls. Dirt which remains can be removed with a soft cloth dampened in a solution of water and mild detergent. Abrasive cleaners should not be used.

Interior. Dust in the interior of the instrument should be removed occasionally due to its electrical conductivity under high-humidity conditions. The best way to clean the interior is to blow off the accumulated dust with dry, low-velocity air. Remove any dirt which remains with a soft paint brush or a cloth dampened with a mild detergent and water solution. A cotton-tipped applicator is useful for cleaning in narrow spaces.

Lubrication

The reliability of switches and other moving parts can be maintained if they are kept properly lubricated. Use a cleaning-type lubricant (e.g., Tektronix Part No. 006-0172-00) for the switch contacts. This lubricant does not affect the electrical characteristics of the switch. To lubricate the switch detent, use a heavier lubricant (e.g., Tektronix Part No. 006-0219-00). Do not over-lubricate.

Visual Inspection

The Type 142 should be inspected occasionally for such defects as broken connections, loose or disconnected pin connectors, improperly seated solid-state devices, damaged circuit boards and heat-damaged components.

The corrective procedure for most defects is obvious; however, particular care must be taken if heat-damaged components are found. Overheating usually indicates other trouble in the instrument; therefore, it is important that the cause of overheating be corrected to prevent recurrence of the damage.

Transistor and Integrated Circuit Checks

Periodic checks of the transistors and integrated circuits (ICs) used in the Type 142 are not recommended. The best indication of performance is the actual operation of the component in the circuit. Performance of the circuit is thoroughly checked during recalibration; substandard transistors and integrated circuits will usually be detected at that time.

Recalibration

To insure correct and accurate instrument operation, the instrument calibration should be checked each 1000 hours of operation or at least every six months. Performance Check and Calibration procedures are given in Section 5.

The calibration procedure can be helpful in isolating major troubles in the instrument. In some case, minor troubles not apparent during normal operation may be revealed and corrected during calibration.

CORRECTIVE MAINTENANCE

General

Corrective maintenance consists of component replacement and instrument repair. Special techniques or procedures required to replace components in this instrument are described here.

Obtaining Replacement Parts

Standard Parts. All electrical and mechanical replacement parts for the Type 142 can be obtained through your local Tektronix Field Office or representative. However, many of the standard electronic components can be obtained locally in less time than is required to order them from Tektronix, Inc. Before purchasing or ordering replacement parts, consult the Parts List for value, tolerance and rating.

NOTE

When selecting replacement parts, it is important to remember that the physical size and shape of a component may affect its performance at high frequencies. All replacement parts should be direct replacements unless it is known that a different component will not adversely affect instrument performance.

Special Parts. In addition to the standard electronic components, some special parts are manufactured or selected by Tektronix, Inc. to meet specific performance requirements or are manufactured specifically for Tektronix, Inc. These special parts are indicated in the Parts List by an asterisk preceding the part number. Most of the mechanical parts used in this instrument have been manufactured by Tektronix, Inc. Order all special parts directly from your Tektronix Field Office or representative.

Ordering Parts. When ordering replacement parts from Tektronix, include the following information:

1. Instrument type.

2. Instrument serial number.

3. A description of the part (if electrical, include circuit number).

4. Tektronix Part Number.

Soldering Techniques

WARNING

Disconnect the instrument from the power source before soldering.

Circuit boards. Use ordinary 60/40 solder and a 15 to 30 watt pencil type soldering iron on the circuit boards. A higher wattage soldering iron may separate the etched wiring from the base material.

The tip should be made of copper and have a chisel or beveled shape, with a 1/8-inch width. The tip of the iron should be clean and properly tinned for best heat transfer to the solder joint.

The following technique should be used to replace a component on a circuit board:

1. Grip the component lead with long-nose pliers. Touch the soldering iron to the lead at the solder connection. Do not lay the iron directly on the board.

2. When the solder begins to melt, pull the lead out gently. This should leave a clean hole in the board. If not, the hole can be cleaned by reheating the solder and placing a sharp object such as a toothpick into the hole to clean it out. A vacuum-type de-soldering tool can also be used for this purpose. If the removal is not accomplished in the first few seconds of heat application, go to another connection or wait a few minutes before reheating the connection. This is to avoid transferring too much heat to the circuit board base material.

3. Bend the leads of the new components to fit the holes in the board. If the component is replaced while the board is mounted in the instrument, cut the leads so they will just protrude through the board. Insert the leads into the holes in the board so the component is firmly seated against the board (or as positioned originally). If it does not seat properly, heat the solder and gently press the component into place.

4. Touch the iron to the connection and apply a small amount of solder to make a firm solder joint; do not apply too much solder. To prevent heat-sensitive components, hold the lead between the component body and the solder joint with a pair of long-nose pliers or other heat sink.

5. Clean the area around the solder connection with a flux-remover solvent. Be careful not to remove information printed on the board.

Metal Terminals. When soldering to metal terminals (e.g., switch terminals, potentiometers, etc.) ordinary 60/40 solder can be used. Use a soldering iron with a 40- to 75-watt rating and 3/16-inch wide wedge-shaped tip.

Observe the following precautions when soldering to metal terminals:

1. Apply only enough heat to make the solder flow freely.

2. Apply only enough solder to form a solid connection. Excess solder may impair the function of the part.

3. If a wire extends beyond the solder joint, clip off the excess.

4. Clean the flux from the solder joint with a flux-remover solvent.

Component Replacement

WARNING

Disconnect the instrument from the power source before replacing components.

Interconnecting Wires. All interconnecting wires on the Type 142 circuit boards use pin connectors. Most of these pin connectors are held in place with special type plastic holders. Should removal of an interconnecting wire(s) become necessary, the following procedure outlines the removal and replacement.

CAUTION

Do not attempt to remove a single interconnecting wire from the holder until the complete assembly has been removed from the circuit board.

REMOVAL:

1. Grasp the connector at each end and pull straight away from the circuit board.

2. Using a small screwdriver, apply a small amount of pressure between the back of the metal pin connector and the holder. This will allow the pin connector to unsnap from the holder.

3. Grasp the top of the pin connector and remove from the holder.

REPLACEMENT:

NOTE

Before replacing wires, check the wire color codes for the particular circuit boards. These are given in Fig. 4-5 through Fig. 4-16.

1. Insert the pin connector (wide side towards the back) into the holder.

2. Apply pressure to the upper portion of the pin connector until it snaps into the holder.

3. Align the small triangle on the holder body with the triangle on the circuit board and mate the pin connectors.

4. Press the holder firmly down against the circuit board.

Circuit Boards. If the circuit board is damaged beyond repair, replacement can be made of the entire assembly including all soldered-on components, or of the board alone. Part numbers are given in the Mechanical Parts List for either the completely wired or the unwired board. The following procedure outlines the removal and replacement of the boards.

REMOVAL:

1. Remove all interconnecting wires from the circuit boards.

2. Remove board hold-down screws (Output Amplifier, Power Supply, Convergence Pattern, and Subcarrier Output, and Pal Lock only) and/or unsnap one edge of the board from the plastic mounting clips.

3. Remove the circuit board.

REPLACEMENT:

1. Replace the hold-down screws and/or insert one edge of the circuit board so that the board notches fit into the plastic mounting clips.

2. Snap the circuit board into place.

3. Reconnect all interconnecting wires to the circuit board.

Transistor and Integrated Circuit Replacement. Transistor and integrated circuits, (ICs) should not be replaced unless they are actually defective. Replacement or exchange of components may affect the calibration of the instrument. If a transistor or integrated circuit is removed during routine maintenance, return it to its original socket.

Any replacement component should be of the original type or a direct replacement. Bend the leads to fit the socket and cut the leads to the same length as on the component being replaced. Use Fig. 4-1 as a reference for insertion.

The chassis-mounted power supply transistors and their mounting bolts are insulated from the chassis. In addition, silicone grease is used to increase heat transfer capabilities. Re-install the insulators and replace the silicone grease when replacing these transistors. The grease should be applied to both sides of the mica insulators, and should be applied to the bottom side of the transistor where it comes in contact with the insulator.

WARNING

1. Silicone grease should be handled with care and should be kept away from the eyes. Wash hands thoroughly after contact with the grease.

2. Voltages are present on the exterior surface of the chassis-mounted power supply transistors if the power is applied to the instrument and the POWER switch is on.

After any component is replaced, check the operation and calibration of the associated circuits.

Indicator Lamp Replacement. The oven lamp can be removed from the front panel. To remove the lamp, unscrew the lens; use fingernails to grip the lamp, and pull outward. To replace the lamp, insert it and rotate it while applying light pressure. After the pins align with the socket, push the lamp fully into place. Replace the lens.

To remove the Power On indicator lamp, first remove the top cover from the instrument. Then, reach behind the front panel and unplug the lamp from its holder. To replace the lamp, reverse the procedure.

Fuse Replacement. Both line fuses are contained in plastic holders in the cover for the Line Voltage Selector Assembly at the rear of the instrument. To remove the fuses, disconnect the line cord from the power source and remove the cover of the assembly. Push on the end of the fuse to be removed and slide it out of the holder. Replace the fuse in a similar manner, being sure the cover fits snugly against the rear panel of the instrument.

Use only the correct value replacement fuse. A smaller value will tend to blow out; a larger value will not provide adequate protection for the instrument. Only the upper fuse within the assembly (3/4 A) is used for 115-volt operation. However, for 230-volt operation both the upper and lower fuse (1/2 A) must be installed.

Switches. If a switch is defective, replace the entire assembly. Replacement switches can be ordered by referring to the Parts List for the applicable part numbers.

When replacing a switch, tag the leads and switch terminals with corresponding identification tags as the leads are disconnected. Then, use the old switch as a guide for installing the new one. An alternative method is to draw a sketch of the switch layout and record the wire color at each terminal. When soldering to a new wafer type switch, be careful that the solder does not flow beyond the rivets on the switch terminals. Spring tension of the switch contact can be destroyed by excessive solder.

Power Transformer Replacement. The power transformer in this instrument is warranted for the life of the instrument. If the power transformer becomes defective, contact your local Tektronix Field Office or representative for a warranty replacement (see the Warranty note in the front of the manual). Be sure to replace only with a direct replacement Tektronix transformer.

When removing the transformer, tag the leads with the corresponding terminal numbers to aid in connecting the new transformer. After the transformer is replaced, check the performance of the complete instrument using the Performance Check procedure.

Power Input Connector and RFI Filter Replacement. The Input Connector and RFI Filter is replaceable as a unit and repair should not be attempted. If replacement is necessary, observe proper polarity to assure instrument protection.

The narrow blade (terminal no. 4) should show continuity to terminal no. 3 which connects to fuse F2, see diagram ⟨8⟩. The filter contains an internal non-replaceable fuse between these two terminals. Use care when soldering to terminals no. 1 and 3, as excess solder could possibly short the filter case.

TROUBLESHOOTING

Introduction

The following information is provided to facilitate troubleshooting of the Type 142. Information contained in other sections of this manual should be used along with the

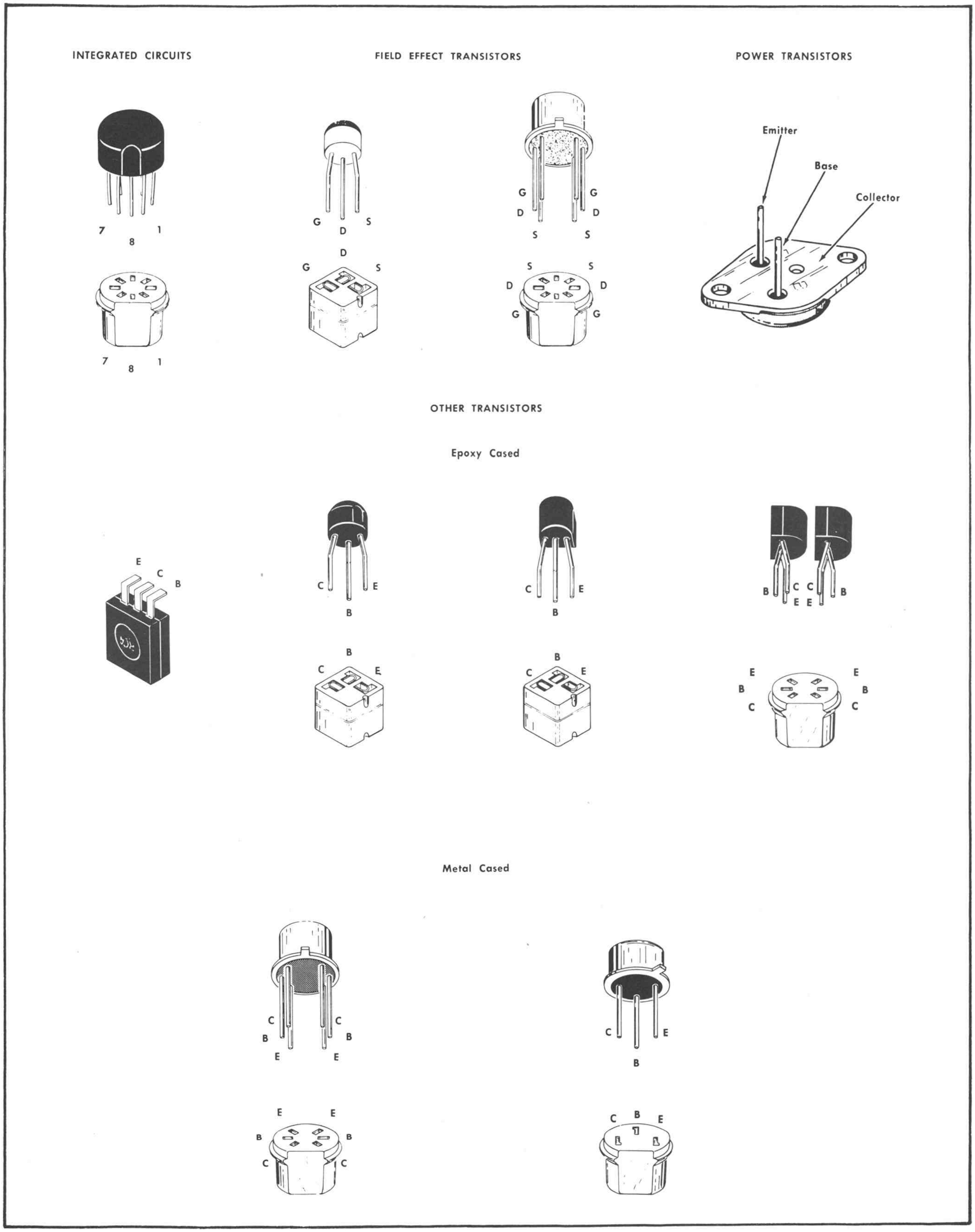


Fig. 4-1. Electrode configuration for socket mounted Integrated Circuits and Transistors.

following information to aid in locating the defective component. An understanding of the circuit operation is very helpful in locating troubles. See the Circuit Description section for complete information.

Troubleshooting Aids

Diagrams. Circuit diagrams are provided on foldout pages in Section 8. The component number and electrical value of each component in this instrument are shown in the diagram. Each main circuit is assigned a diagram number. Table 4-1 lists the main circuits in the Type 142 and their assigned diagram numbers. Important voltages and waveforms are also shown on the diagrams. The portions of a circuit mounted on circuit boards are enclosed with a blue-line. Also included are the circuit board interconnecting wire and switching diagrams.

TABLE 4-1

Diagram	Circuit
1	Modulator
2	Bar Timing
3	Field Timing
4(a)	Color Bar Drive
4(b)	Video Out
5	Staircase
6(a)	Line Timing
6(b)	Subcarrier & Sync Source Switching
7	Crosshatch & Dot Generator
8	Power Supply
9	Output Amplifiers
10 & 11	Subcarrier Oscillator & Output
12	PAL Lock

Switch Waver Identification. The VITS Line selector switch shown on the Field Timing diagram is coded to indicate the position of the wafer in the complete switch assembly. The numbered portion of the code refers to the wafer number counting from the front, or mounting end of the switch, toward the rear. The letters 'F' and 'R' indicate whether the front or rear of the wafer performs the particular switching function. For example, a wafer designated 3R on the diagram indicates that the rear of the third wafer is used for this particular switching function.

Circuit Boards. Fig. 4-4 shows the location of each circuit board within the instrument. Fig. 4-5 through 4-16 show a full view of each circuit board. Each electrical component on the boards is identified by its circuit number, and all wire color codes are shown. These pictures, used along with the diagrams, aid in locating the components on the circuit boards.

Wire Color Code. All insulated wires in the Type 142 are color coded to facilitate circuit tracing. Table 4-2 summarizes the coding system used in this instrument.

TABLE 4-2

Color Code	Significance
Black	Chassis Ground
White on Black	Floating ground
Yellow on Green	Safety ground
Brown[1]	Filament and heaters
Gray[1]	AC line
White[1]	Signal
Red[2]	B+
Violet[2]	B−

[1] Color stripes are used on these wired as an aid to circuit tracing.

[2] Color stripe on wire indicates position of supply with respect to 0 volts (e.g., a brown stripe on a red wire would be the second voltage in the positive direction). If a second stripe is used (white only), this indicates a non-regulated supply.

Table 4-3 is provided to list the wire color code for the regulated non-decoupled DC power supply voltages used in the Type 142.

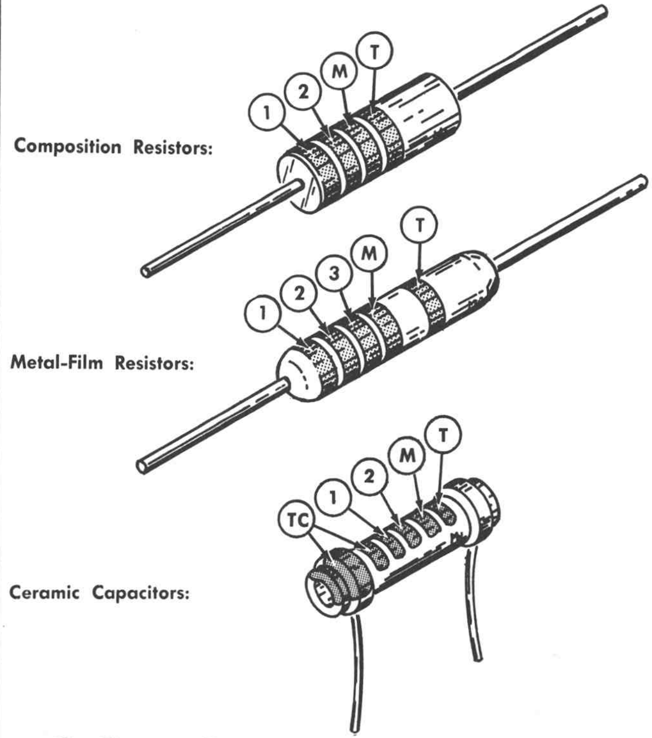
TABLE 4-3

Type 142 Power Supply Wire Color Code

Supply	Color Code
−15 V	Black on Violet
+ 3.6 V	Black on Red
+ 10 V	Brown on Red

Resistor Color Code. In addition to the brown composition resistors, metal film resistors (identifiable by their gray or light blue color) are used in the Type 142. The resistance value of composition and metal film resistors is color-coded on the components with the standard EIA color code. The color code is read starting with the stripe nearest the end of the resistor. Composition resistors have four stripes consisting of two significant figures, a multiplier and a tolerance value. Metal-film resistors have five stripes which consist of three significant figures, a multiplier and a tolerance value (see Fig. 4-2).

Capacitor Marking. The capacitance value of a common disc capacitor or small electroylic is marked in microfarads on the side of the component body. The white ceramic capacitors used in the Type 142 are color-coded in picofarads using a modified EIA code (see Fig. 4-2).



(1) (2) and (3) —1st, 2nd and 3rd significant figures;

(M) —multiplier; (T) —tolerance;

(TC) —temperature coefficient.

Resistor and Capacitor Color Code

Color	Signifi-cant Figures	Multiplier Resis-tors	Multiplier Capaci-tors	Tolerance Resis-tors	Tolerance Capaci-tors
Silver	- - -	10^{-2}	- - -	±10%	- - -
Gold	- - -	10^{-1}	- - -	±5%	- - -
Black	0	1	1	- - -	±20% or 2 pF*
Brown	1	10	10	±1%	±1% or 0.1 pF*
Red	2	10^{2}	10^{2}	±2%	±2%
Orange	3	10^{3}	10^{3}	±3%	±3%
Yellow	4	10^{4}	10^{4}	±4%	+100% −0%
Green	5	10^{5}	10^{5}	±0.5%	±5% or 0.5 pF*
Blue	6	10^{6}	10^{6}	- - -	- - -
Violet	7	- - -	- - -	- - -	- - -
Gray	8	- - -	10^{-2}	- - -	+80% −20% or 0.25 pF*
White	9	- - -	10^{-1}	- - -	±10% or 1 pF*
(none)	- - -	- - -	- - -	±20%	±10% or 1 pF*

***For capacitance of 10 pF or less.**

NOTE: (T) and/or (TC) color code for capacitors depends upon manufacturer and capacitor type. May not be present in some cases.

Fig. 4-2. Standard EIA color coding for resistors and capacitors.

Diode Color Code. The cathode end of each glass-enclosed diode is indicated by a stripe, a series of stripes, or a dot. For metal-enclosed diodes, the anode and cathode are marked on the case. When the diode is a JEDEC registered device, a series of stripes indicates the diode type number using the EIA color-code system. On diodes manufactured especially for Tektronix, a four-band color code system is used, the first band of which is either blue or pink. On the latter type of diodes, the last three bands identify the diode within a class of part numbers (e.g., a diode color coded blue (or pink) brown-gray-green probably indicates Tektronix Part No. 152-0185-00). When in doubt, consult the Parts List.

Transistor and IC Lead Configuration. Fig. 4-1 shows the lead configuration for socket mounted transistors, FETs and ICs used in the Type 142.

Troubleshooting Equipment

The following equipment is useful for troubleshooting the Type 142.

1. Transistor Tester

Description: Tektronix Type 576 Transistor-Curve Tracer or equivalent.

Purpose: To test the semiconductors used in this instrument.

2. Multimeter

Description: VOM, 20,000 ohms/volt DC. 0 to 30-volt range DC, 0 to 150-volt range AC; accuracy within 0.3% to measure power supply output voltages, within 3% for other circuit voltage readings; ohmmeter 0 to 50 megohms. Test prods must be insulated to prevent accidental shorts.

NOTE

This instrument may be checked with a VTVM having a 10 megohm input impedance and a 0 to 30-volt range DC, 0 to 150-volt range AC. To measure power supply voltages, the meter needs accuracy within 0.3%. Accuracy within 3% is adequate for other circuit voltage readings. The ohmmeter needs a range of 0 to 50 megohms.

Purpose: To check voltages and for general troubleshooting in this instrument.

3. Test Oscilloscope

Description: DC to 10 MHz frequency response (signal tracing). 10 millivolts to 10 volts/division deflection factor using a 10X probe.

Purpose: To check waveforms in this instrument.

Troubleshooting Techniques

This troubleshooting procedure is arranged in an order which checks the simple possibilities before proceeding with extensive troubleshooting. The first few checks assure proper connection, operation and calibration. If the trouble is not located by these checks, the remaining steps aid in locating the defective component. When the defective component is located, it should be replaced following the replacement procedure given under Corrective Maintenance.

1. Check Control Settings. Incorrect control settings can indicate trouble that does not exist. If there is any question about the correct function or operation of any control, see the Operating Instructions.

2. Check Associated Equipment. Before proceeding with troubleshooting of the Type 142, check that the equipment used with the instrument is operating correctly. Check that the signal is properly connected and that the interconnecting cables are not defective. Also, check the power source.

3. Visual Check. Visually check the portion of the instrument in which the trouble is located. Many troubles can be located by visual indications, such as unsoldered connections, loose pin connectors, broken wires, damage circuit boards, damaged components, etc.

4. Check Instrument Calibration. Check the calibration of this instrument, or the affected circuit if the trouble exists in one circuit. The apparent trouble may only be a result of misadjustment and may be corrected by calibration. Complete calibration instructions are given in the Performance Check/Calibration section.

5. Isolate Trouble to a Circuit. To isolate trouble to a circuit, note the trouble symptoms. The symptoms often identify the circuit in which the trouble is located. For example, if one luminance step in the composite video staircase signal is absent, this indicates that the Staircase Luminance Amplifier circuit is probably at fault. When trouble symptoms appear in more than one circuit, check affected circuits by taking voltage and waveform readings.

Incorrect operation of all circuits often indicates trouble in the power supply. Check first for correct voltage of the individual supplies. A defective component elsewhere in the circuit can also appear as a power-supply trouble, and affect the operation of other circuits. Table 4-4 lists the tolerance of the power supplies in this instrument when measured at the test points given in the table. Fig. 4-3 shows the locations of these test points. If a power supply voltage is within the listed tolerance, the supply can be assumed to be working correctly. If outside the tolerance, the supply may be misadjusted or operating incorrectly. Use the procedure given in the Calibration section to adjust the power supplies.

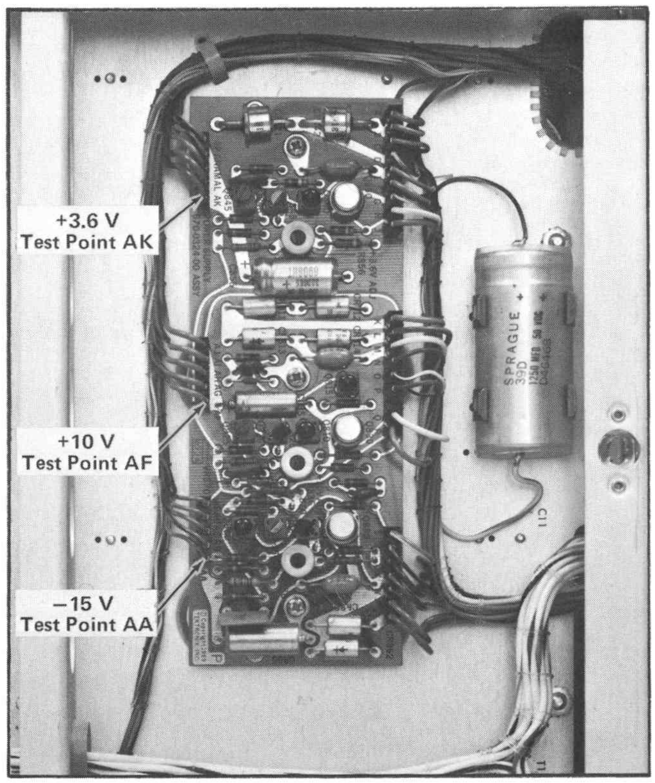


Fig. 4-3. Power Supply board test point locations.

Table 4-4 also lists the approximate power supply resistances when measured between each of the power supply test points and ground. Two resistance measurements are given: (1) With the + (positive polarity) lead of the VOM connected to the power supply test point, and (2) with the — (Negative polarity) lead connected to the same power supply test point. Since these measurements are not absolute and may vary considerably between instruments and because of the type of ohmmeter used, space is provided in the table for filling in the information that pertains to a particular instrument and ohmmeter.

Fig. 3-1 through 3-4 in the Circuit Description section can be used as a guide for isolating a trouble. These illustra-

TABLE 4-4

Power Supply Voltages and Approximate Resistances

Power Supply	Test Point	Tolerance	Type of Meter: Triplett Model: 630-NA Instrument Type: 142 Serial No.:			Type of Meter: Model: Instrument Type: Serial No:		
			Resistance Measurement		Ohms Range Used	Resistance Measurement		Ohms Range Used
			+Lead	−Lead		+Lead	−Lead	
−15 V	AA	±3%	270 Ω	210 Ω	X100			
+3.6 V	AK	±3%	120 Ω	190 Ω	X100			
+10 V	AF	±3%	230 Ω	240 Ω	X100			

tions are functional block diagrams that show how the various signal components are combined to form the composite video signal. By using the front-panel controls and checking the signals at the BNC connectors, it is possible to determine the blocks or circuits that are functioning properly and those that are not.

When a trouble is isolated to the smallest possible area, proceed with step 6 through 8 in this troubleshooting procedure to locate the defective component(s).

6. Check Circuit Board Interconnections. After the trouble has been isolated to a particular area or circuit, check the pin connectors on the circuit board for correct connection. Figs. 4-5 through 4-16 show the correct connections for each board.

The pin connectors used in this instrument also provide a convenient means of circuit isolation. For example, a short in a power supply can be isolated to the power supply itself by disconnecting the power distribution pin connectors for the voltage at the Power supply board when making resistance to ground checks.

7. Check Voltage and Waveforms. Often the defective component can be located by checking for the correct voltage or waveform in the circuit. Typical voltages and waveforms are given on the diagrams.

NOTE

Voltages and waveforms given on the diagrams are not absolute and may vary slightly between instruments. To obtain operating conditions similar to those used to take these readings, see the inside portion of the Modulator diagram pull-out page.

CAUTION

Due to the component density of the circuit boards, care should be taken with meter leads and probe tips. Accidental shorts can cause abnormal voltages or transients which may destroy many components.

WARNING

"Ground lugs" are not always at ground potential. Check the schematic before using such connections as a ground for the voltmeter test prod or oscilloscope probe. Some transistor cases may be elevated.

8. Check Individual Components. The following procedures describe methods of checking individual components in the Type 142. Components which are soldered in place are best checked by first disconnecting one end. This isolates the measurement from the effects of surrounding circuitry.

A. TRANSISTORS (excluding FETs). The best check of transistor operation is actual performance under operating conditions. If a transistor is suspected of being defective, it can best be checked by substituting a new transistor or one which has been checked previously. However, be sure that circuit conditions are not such that a replacement transistor might also be damaged. If substitute transistors are not available, use a dynamic tester (such as Tektronix Type 576). Static-type testers are not recommended since they do not check operation under simulated operating conditions.

B. FET and IC Replacement. FETs and ICs should not be replaced unless they are actually defective. The best method for checking these devices is by direct substitution.

Be sure the voltage conditions of the circuit are not such that the replacement components might also be damaged.

C. DIODES. A diode can be checked for an open or shorted condition by measuring the resistance between terminals. With an ohmmeter scale having an internal source of between 800 millivolts and 3 volts, the resistance should be very high in one direction and very low when the leads are reversed.

CAUTION

Do not use an ohmmeter scale that has a high internal current. High current may damage the diodes.

D. RESISTORS. Check the resistors with an ohmmeter. Check the Electrical Parts List for the tolerances of the resistors used in this instrument. Resistors normally do not need to be replaced unless the measured value varies widely from the specified value.

E. INDUCTORS. Check for open inductors by checking continuity with an ohmmeter. Shorted or partially shorted inductors can usually be found by checking the waveform response when high-frequency signals are passed through the circuit. Partial shorting often reduces high-frequency response (roll-off).

F. CAPACITORS. A leaky or shorted capacitor can best be detected by checking resistance with an ohmmeter on the highest scale. Do not exceed the voltage rating of the capacitor. The resistance reading should be high after initial charge of the capacitor. An open coupling capacitor can best be detected with a capacitance meter or by checking whether the capacitor passes the AC signals.

9. Repair and Readjust the Circuit. If any defective parts are located, follow the replacement procedure given in this section. Be sure to check the performance of any circuit that has been repaired or that has had any electrical components replaced.

NOTES

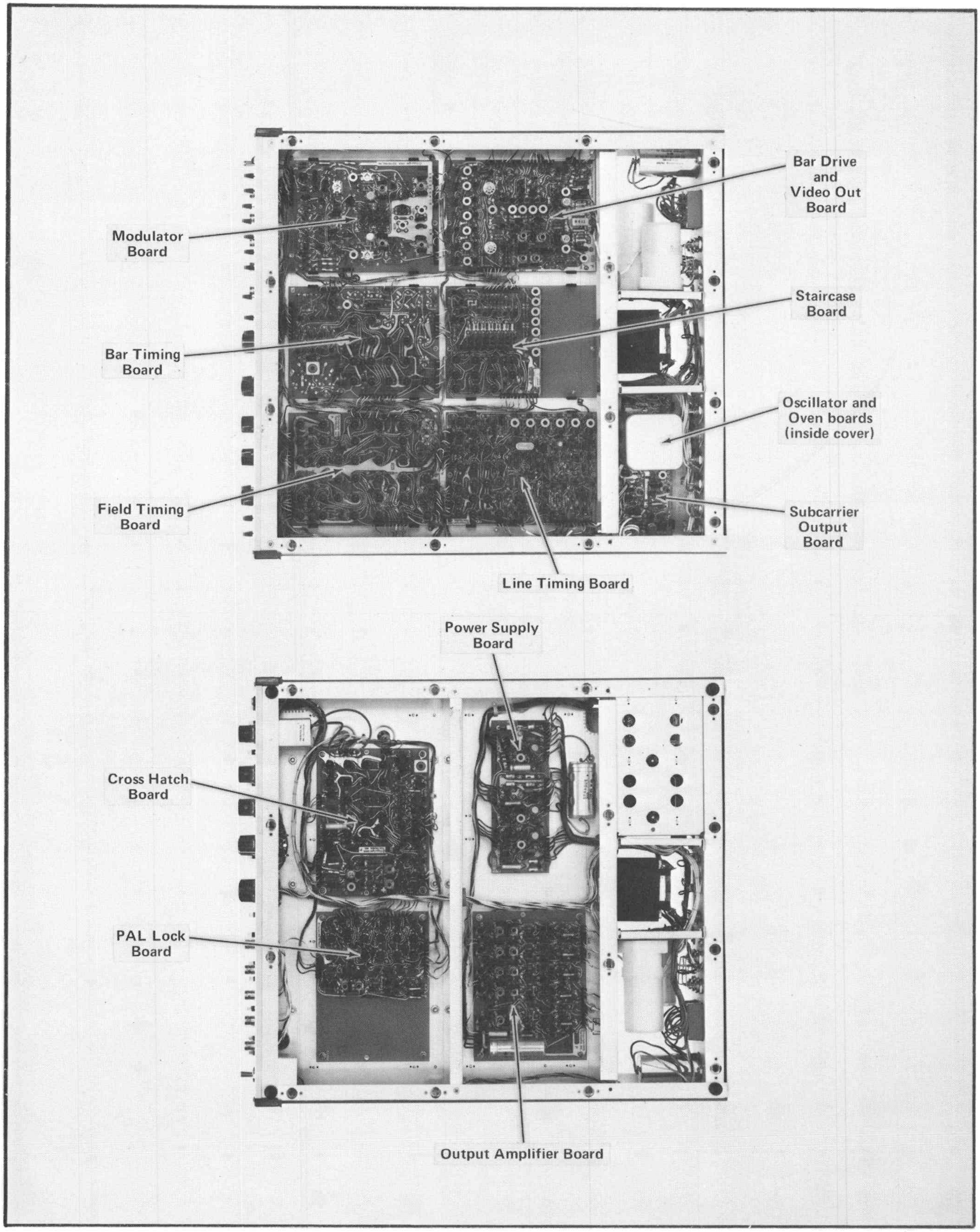


Fig. 4-4. Location of circuit boards in the Type 142.

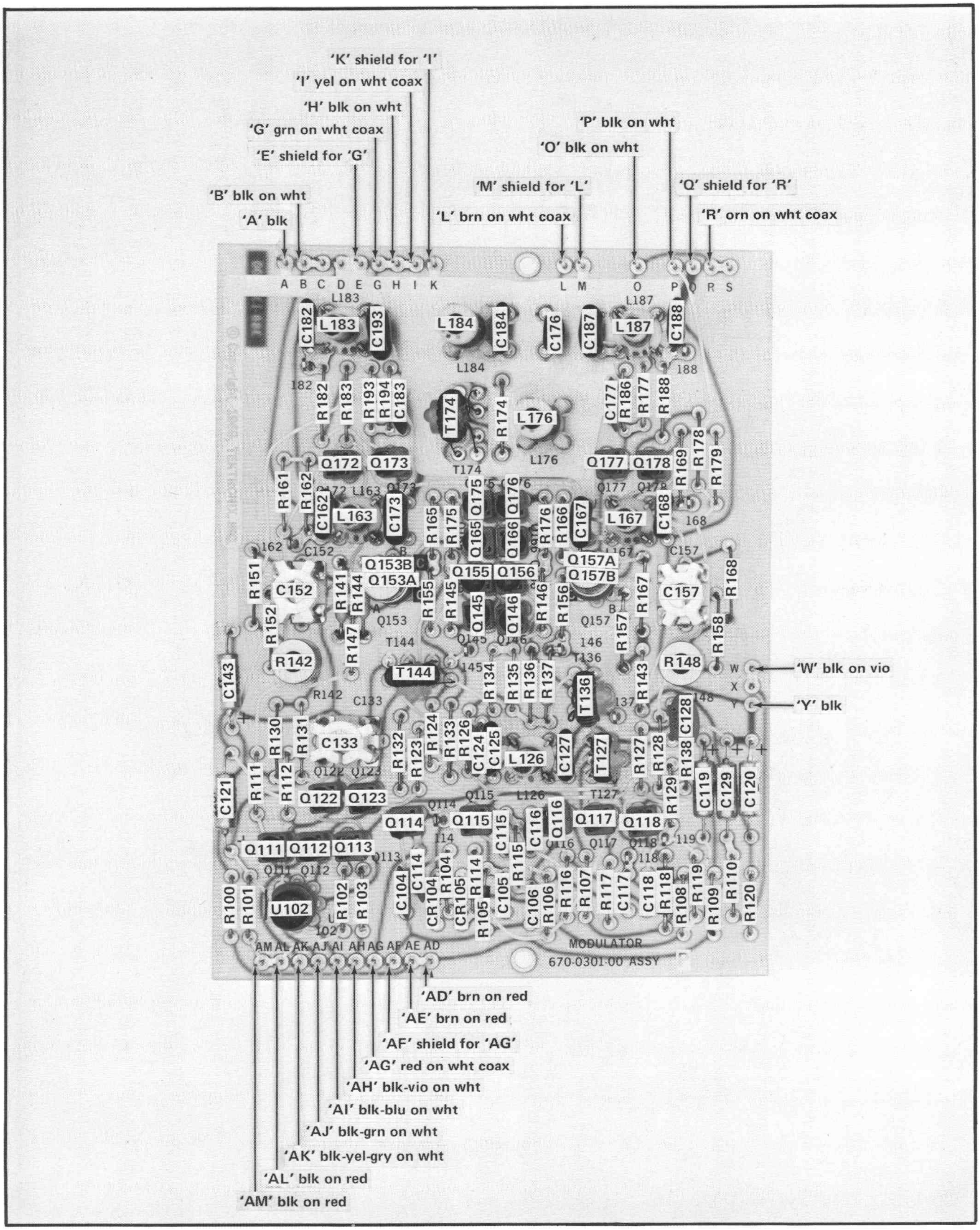


Fig. 4-5. Modulator board; component identification and wire color code.

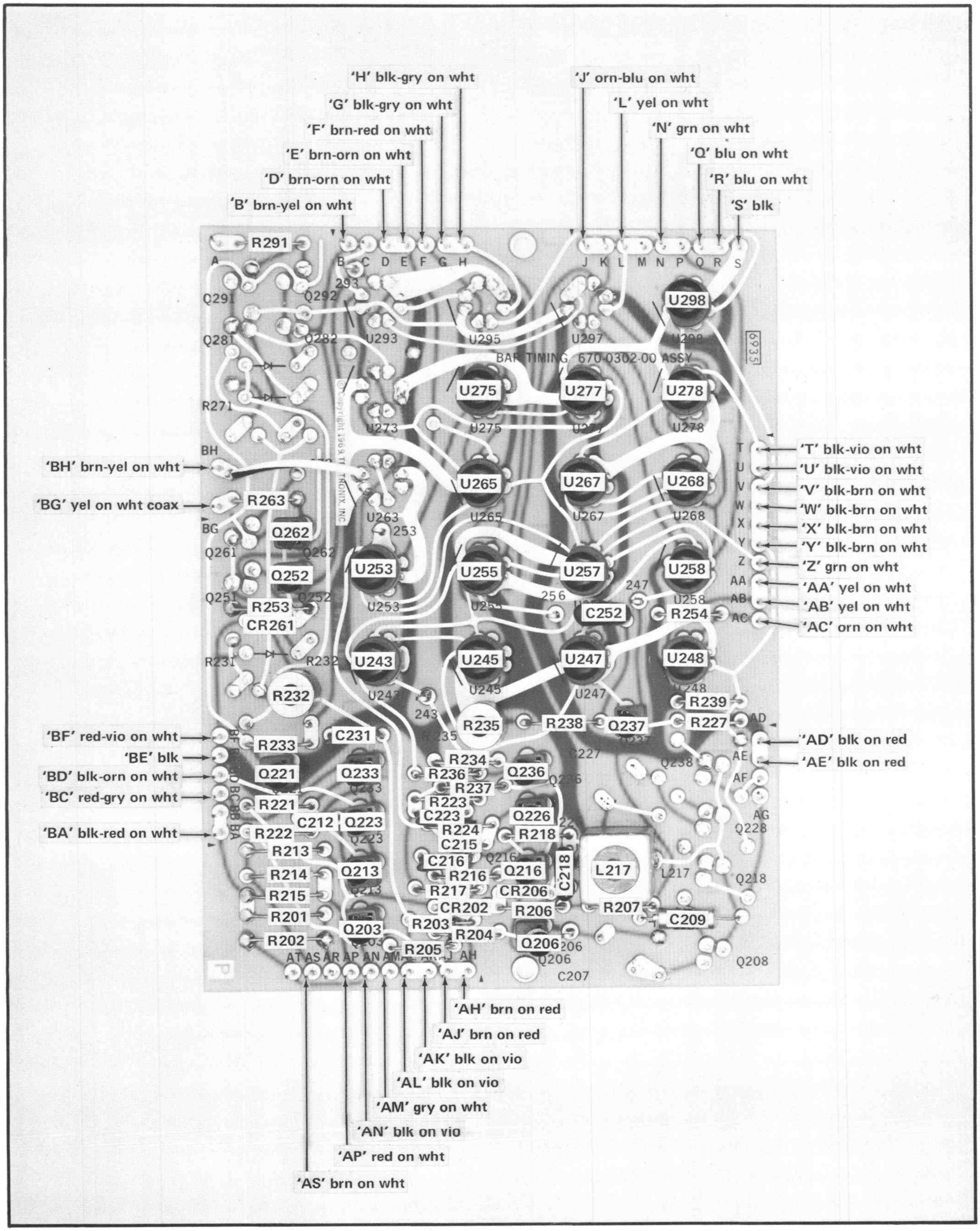


Fig. 4-6. Bar Timing board; component identification and wire color code.

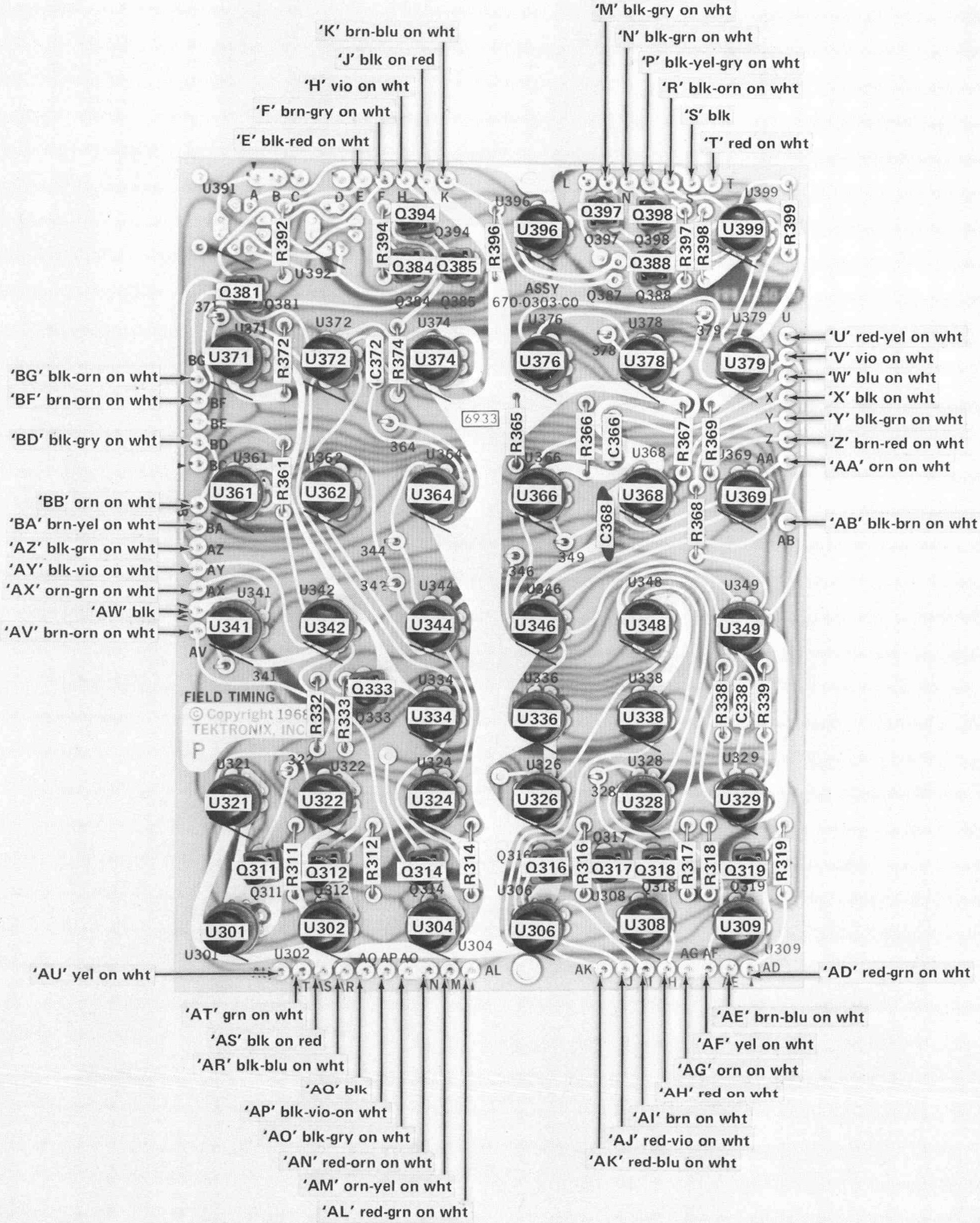


Fig. 4-7. Field Timing board; component identification and wire color code.

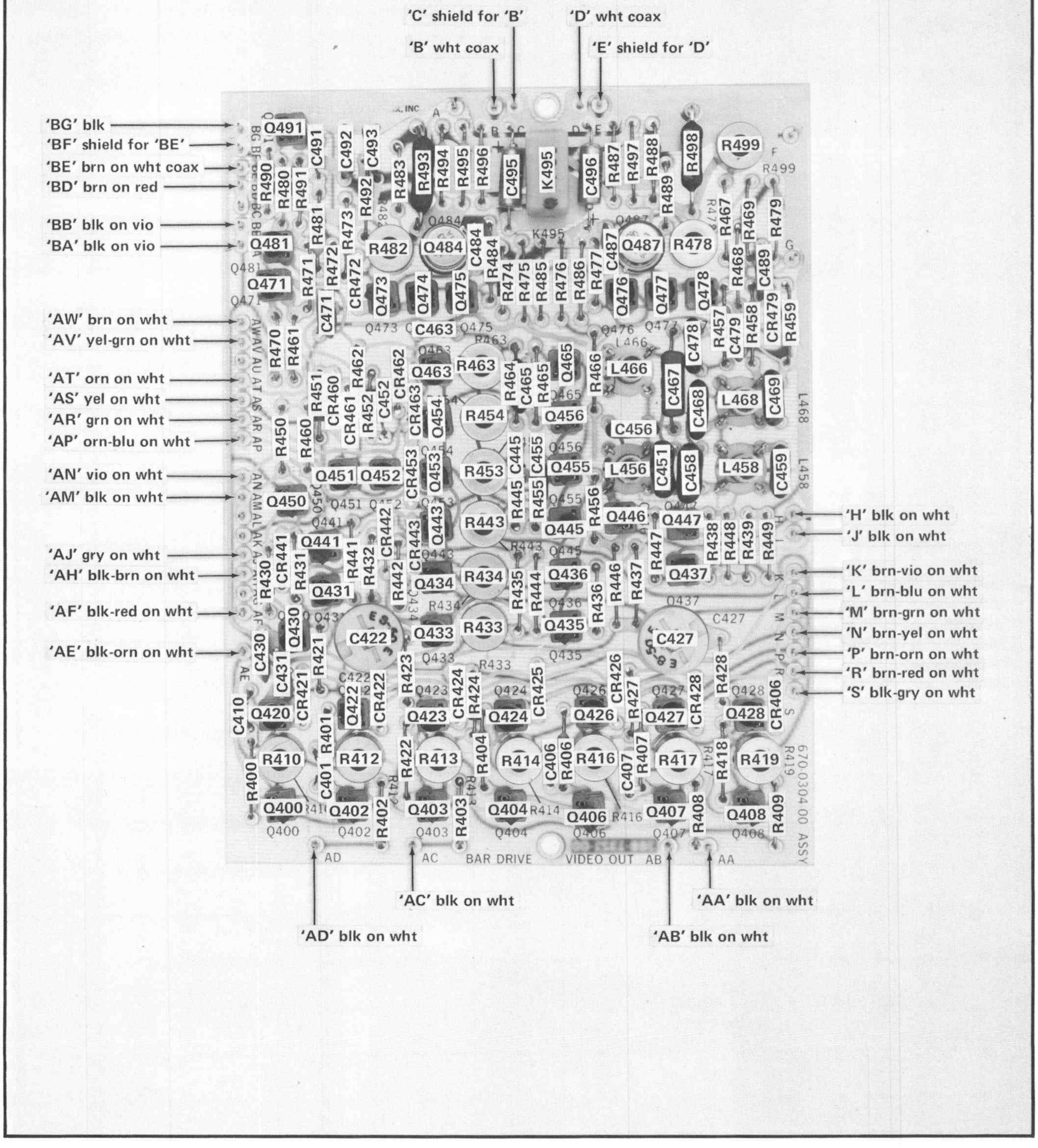


Fig. 4-8. Bar Drive and Video Out board; component identification and wire color code.

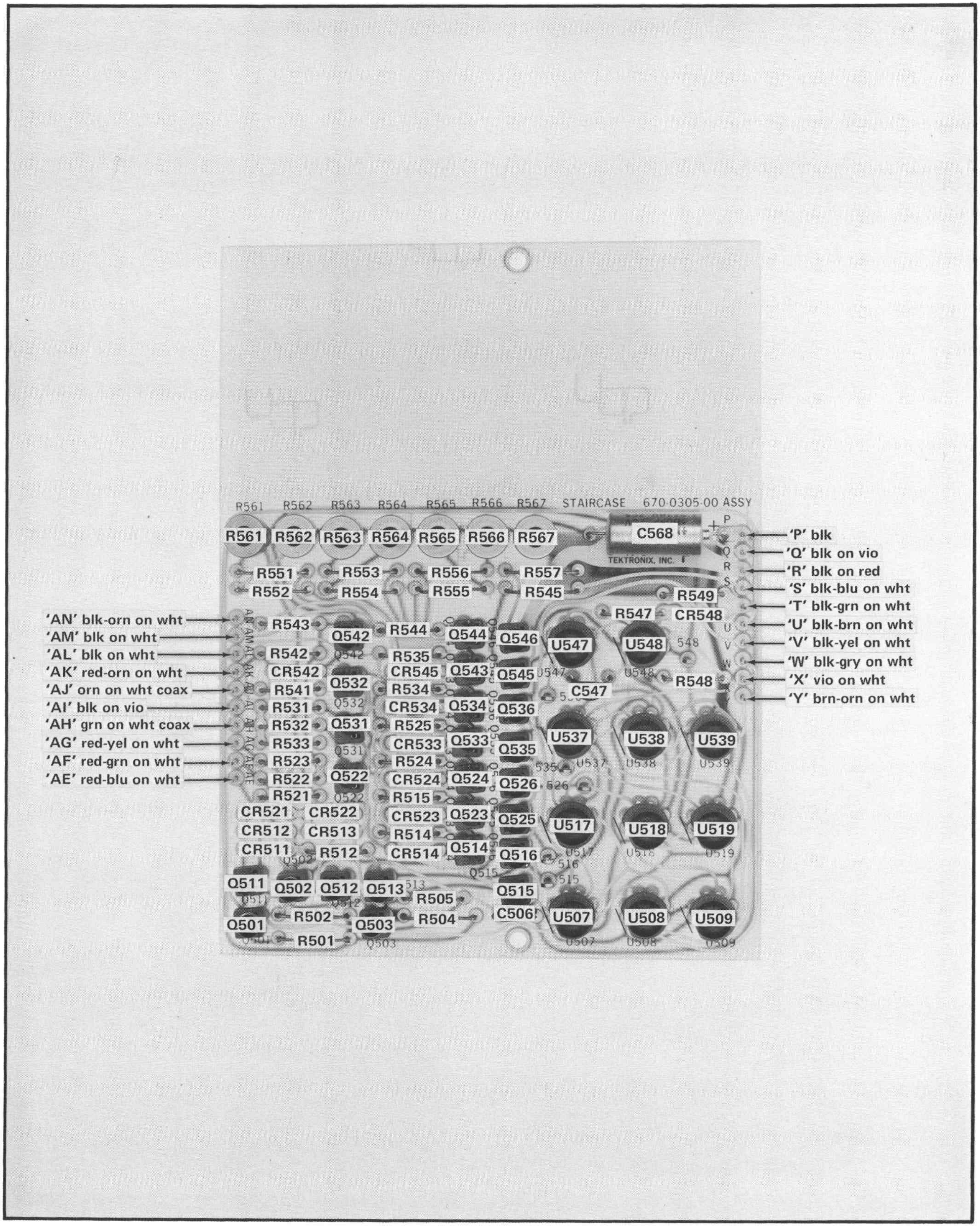


Fig. 4-9. Staircase board; component identification and wire color code.

Ⓐ

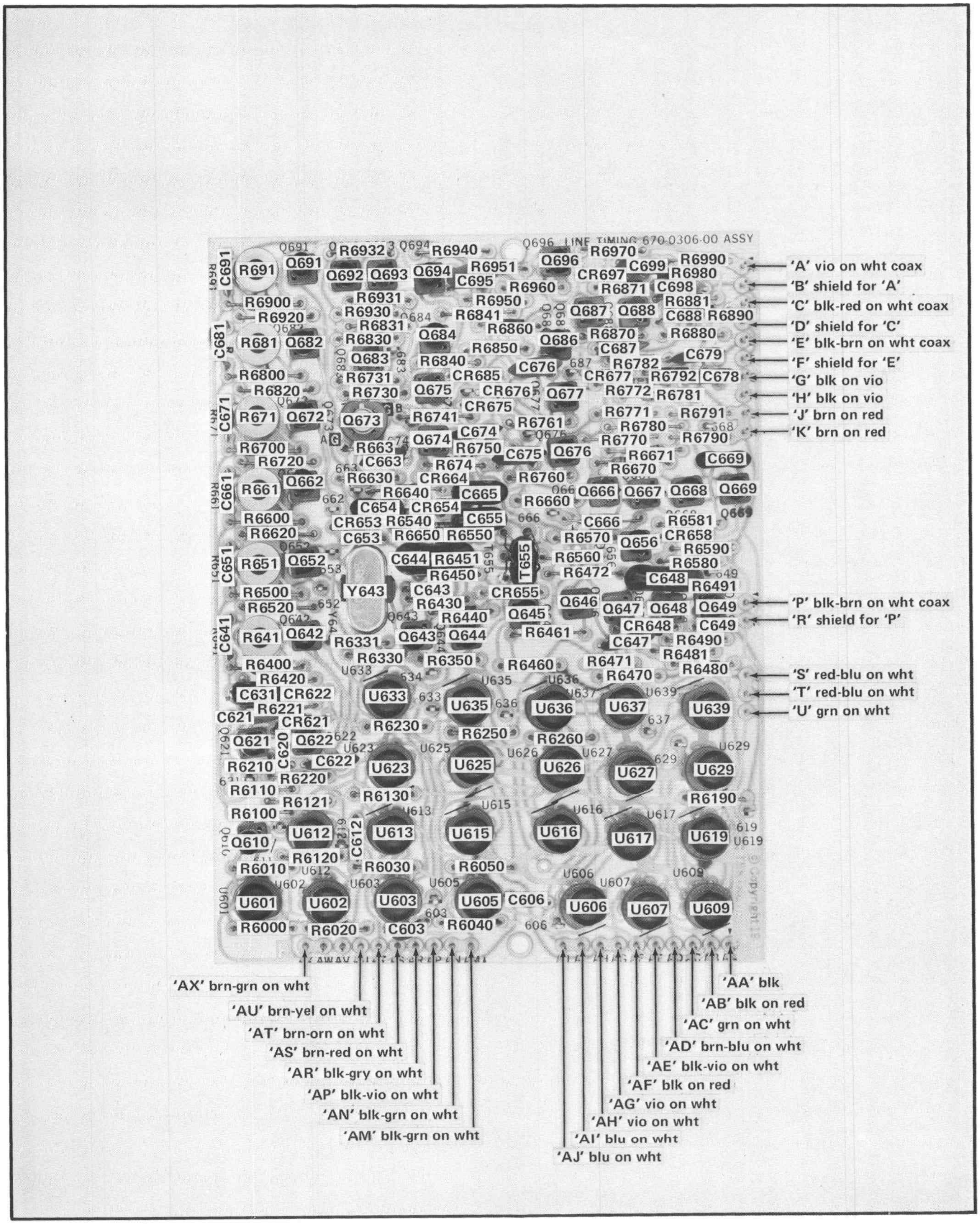


Fig. 4-10. Line Timing board; component identification and wire color code.

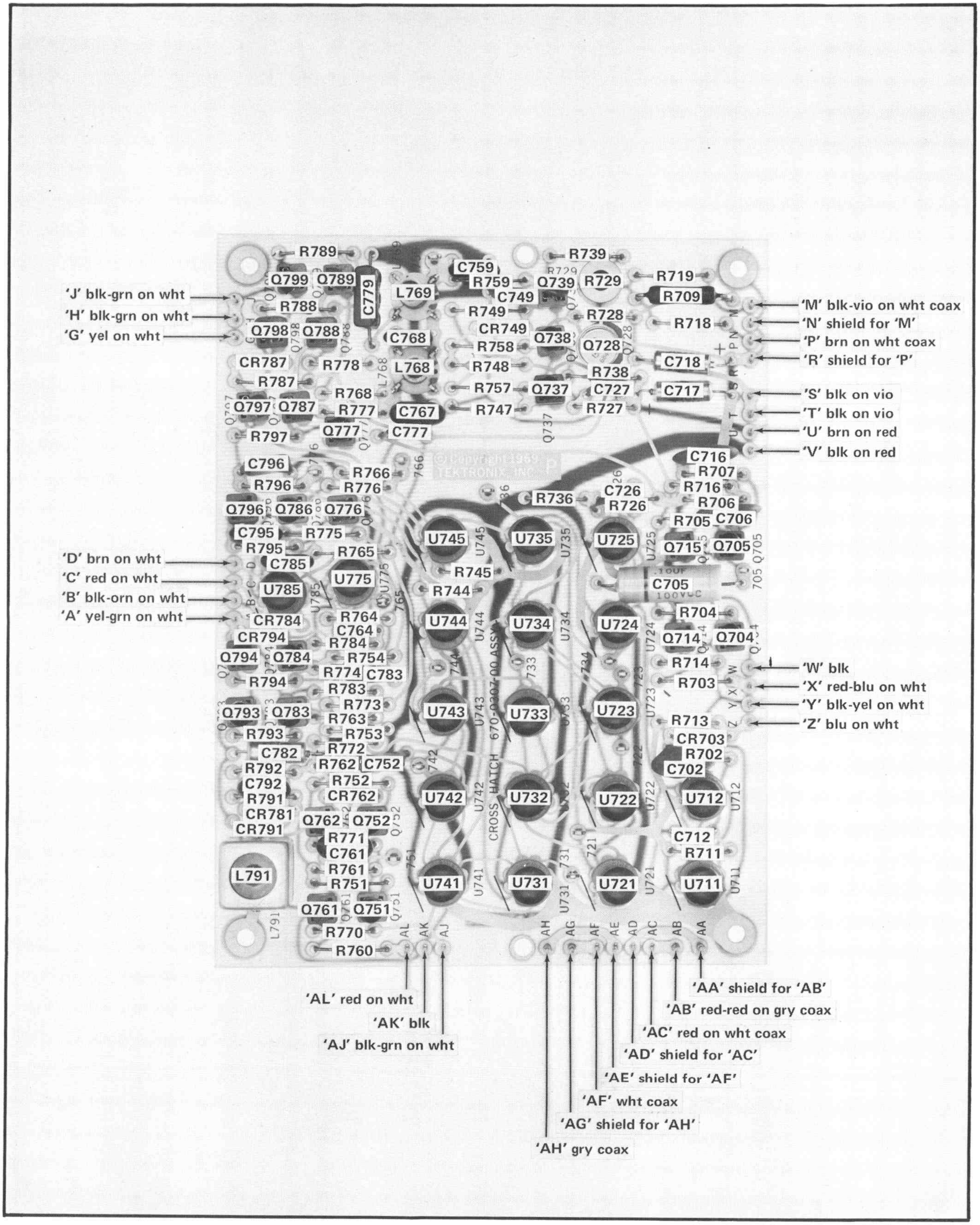


Fig. 4-11. Cross Hatch board; component identification and wire color code.

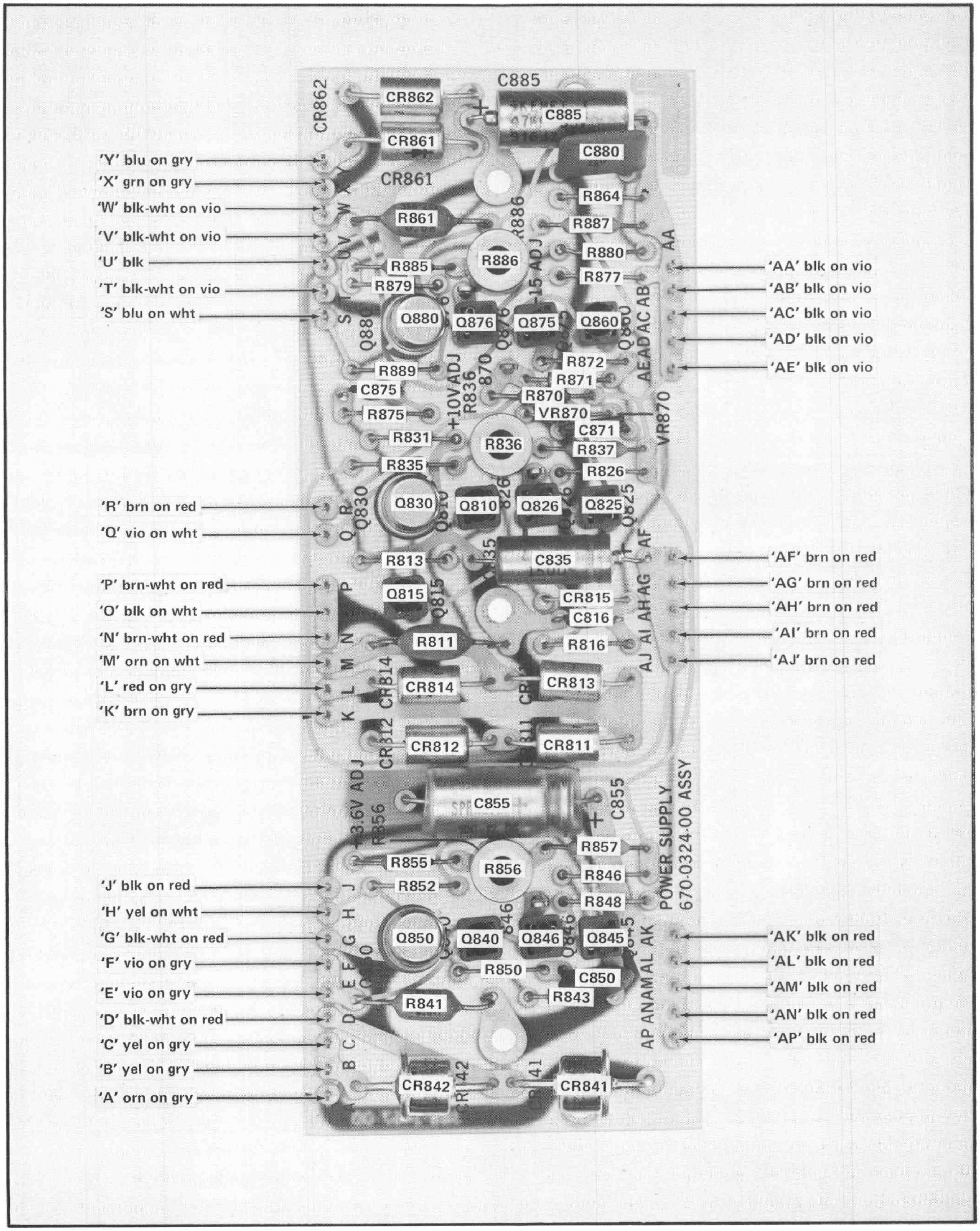


Fig. 4-12. Power Supply board; component identification and wire color code.

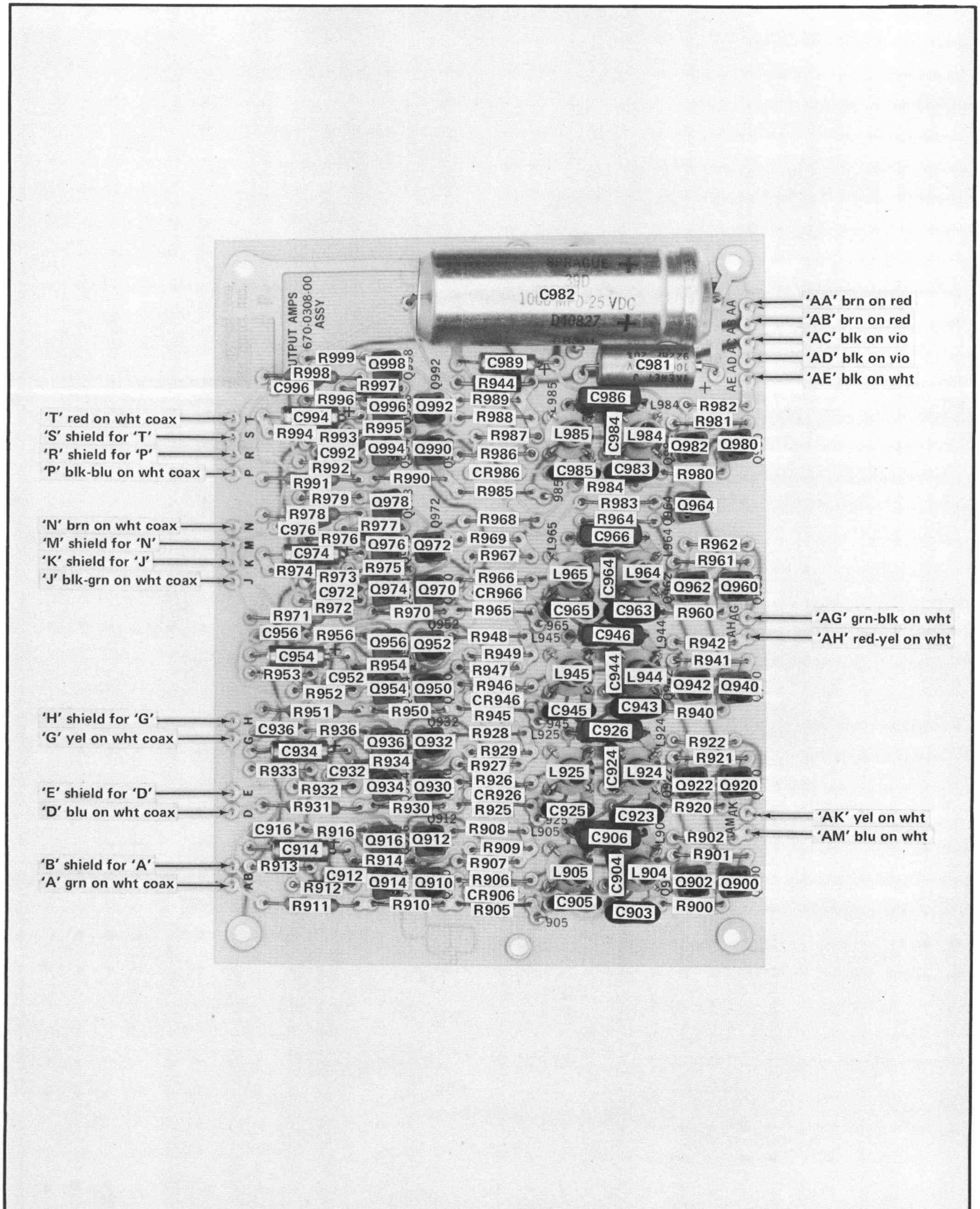


Fig. 4-13. Output Amplifier board; component identification and wire color code.

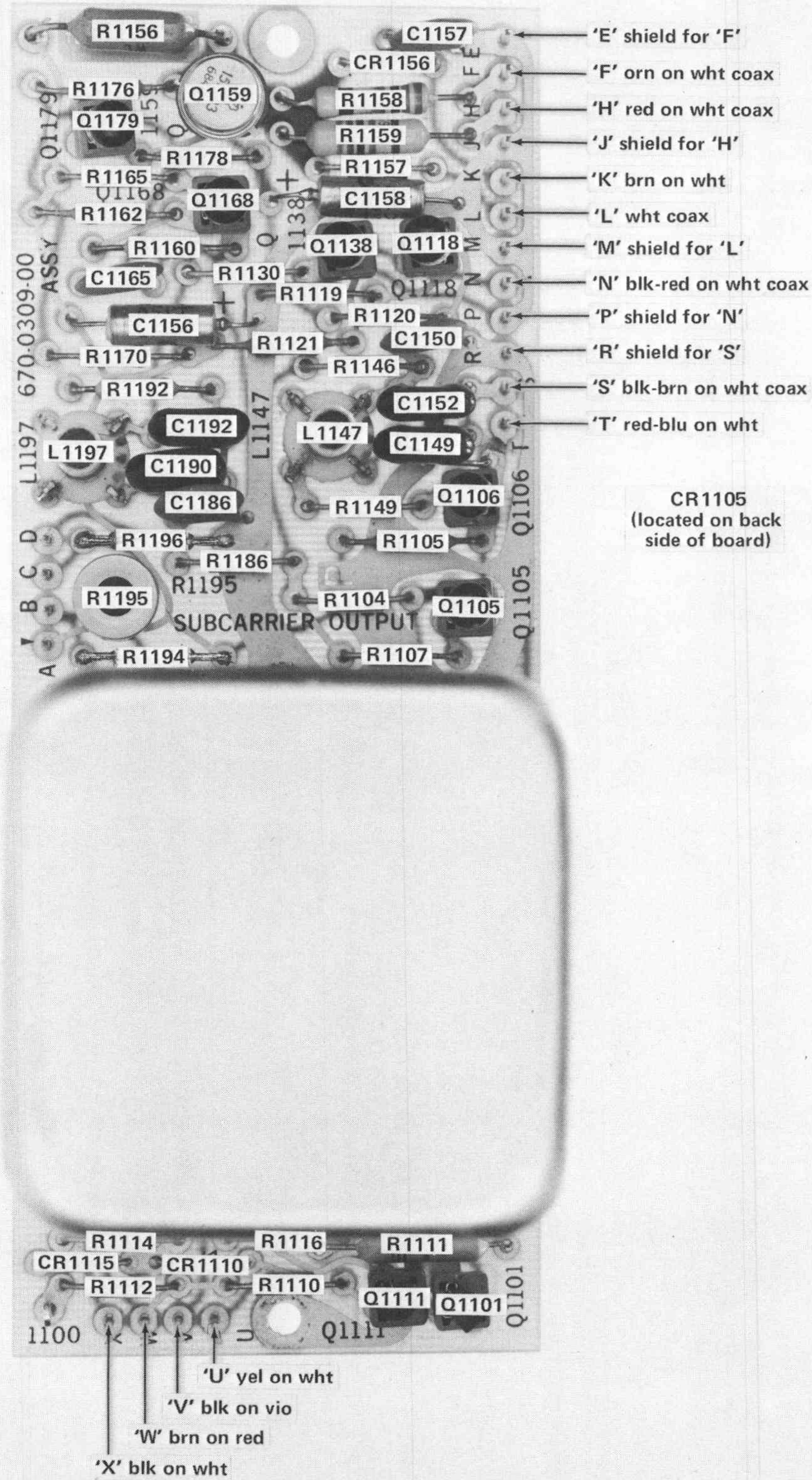


Fig. 4-14. Subcarrier Output board; component identification and wire color code.

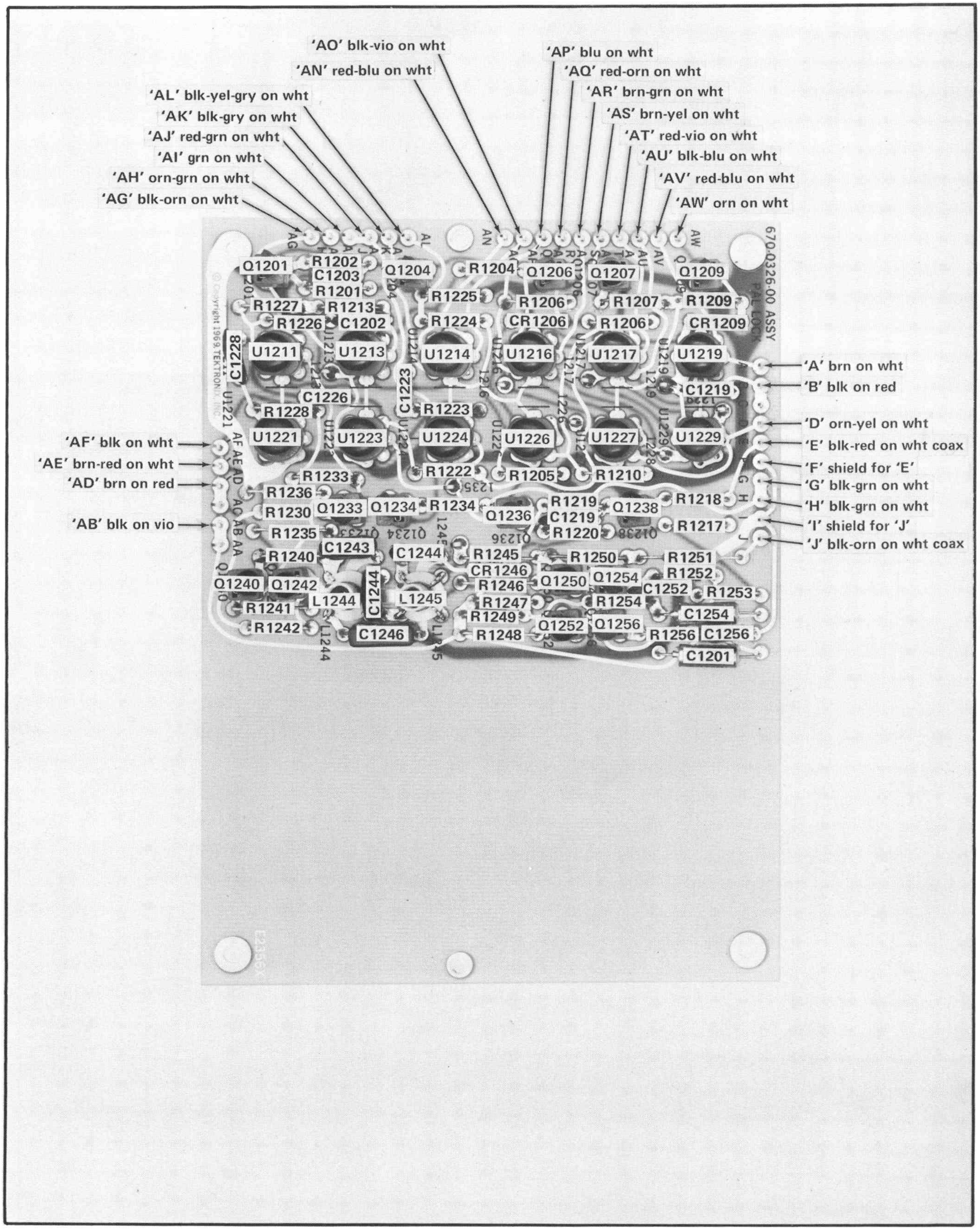


Fig. 4-15. PAL Lock board; component identification and wire color code.

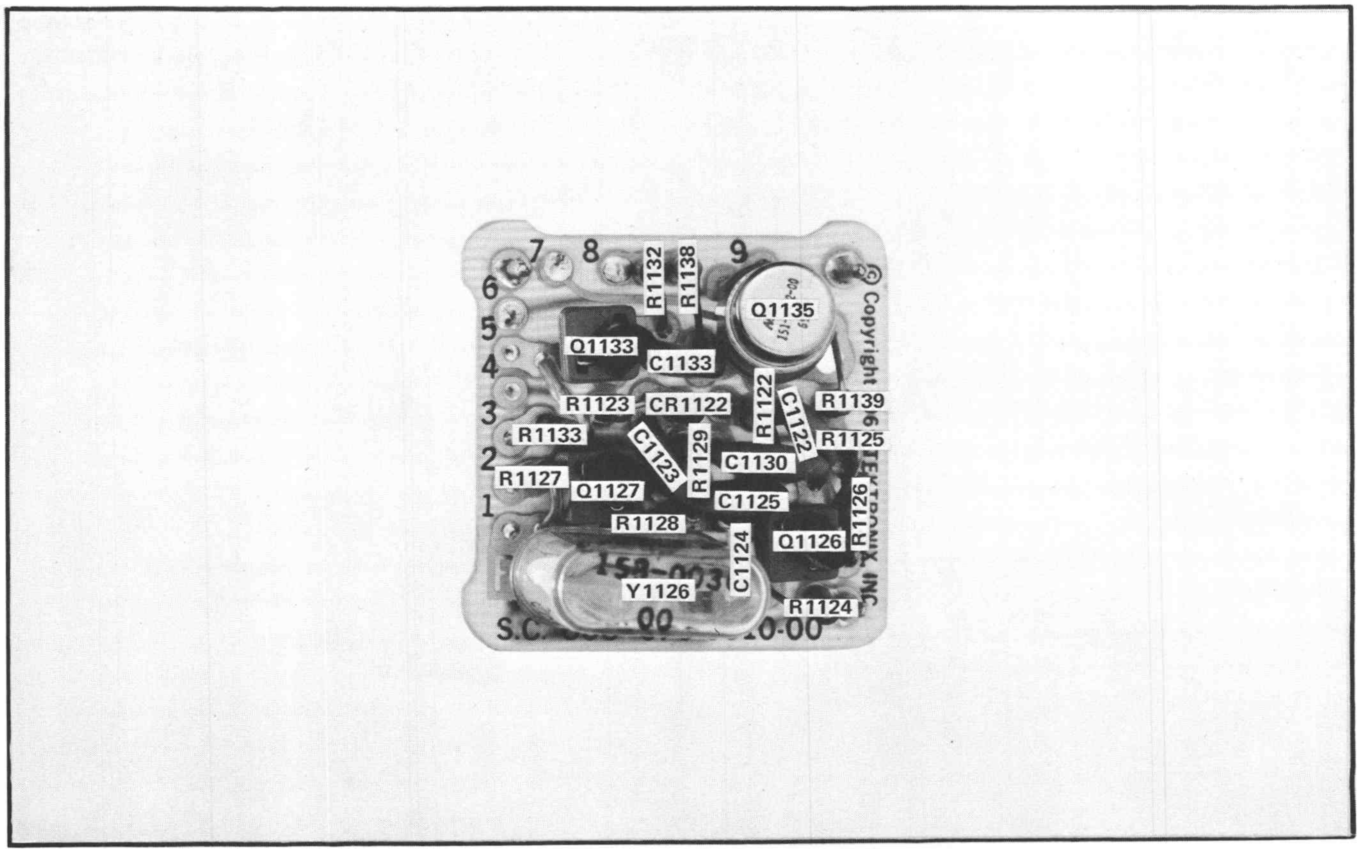


Fig. 4-16. Oscillator board; component identification.

NOTES

SECTION 5
PERFORMANCE CHECK/CALIBRATION

Change information, if any, affecting this section will be found at the rear of the manual.

Introduction

This procedure checks and/or calibrates the instrument to the performance requirements listed in the Specification section. Limits, tolerances, and waveforms in this procedure are given as calibration guides and are not instrument specifications, unless given in the Specification Section. The instrument should not require frequent calibration, but an occasional adjustment will be necessary when transistors, integrated circuits, and other components are changed. Also, a periodic recalibration is desirable from the standpoint of preventive maintenance. The calibration of the instrument should be checked after every 1000 hours of operation or each six months if the instrument is used intermittently.

TEST EQUIPMENT REQUIRED

General

All of the following test equipment, or its equivalent, is required for the complete calibration of the Type 142. Test equipment used is illustrated in the setup pictures for the related steps in the procedure.

Specifications given are the minimum necessary for accurate calibration. All test equipment is assumed to be correctly calibrated and operating within the given specifications. If equipment is substituted, it must meet or exceed the specifications of the recommended equipment.

For ease and accuracy in calibration, special calibration fixtures are used where necessary. All calibration fixtures listed are available from Tektronix, Inc. Order by part number through your local Tektronix Field Office or representative.

Equipment List

1. Precision DC Voltmeter. Accuracy, within ±0.3%; range, 3 to 15 volts. For example, Fluke Model 825A.

2. Test Oscilloscope. Bandwidth, DC to at least 30 MHz; minimum deflection factor, 1 mV/division; DC offset voltage, 0 to 1 volt; two input channels providing choice of independent channel operation or differential operation; sweep magnification, X100. A Tektronix Type 547 oscilloscope with a Type 1A5 Plug-In unit was used for the procedure.

3. Variable Autotransformer. Must be capable of supplying at least 200 volt-amperes over a voltage range of 90 to 136 volts (180 to 272 volts for 230 volt nominal line). If autotransformer does not have an AC Voltmeter to indicate output voltage, monitor output with an AC Voltmeter (RMS) with a range of at least 136 volts (or 272 volts). For example, General Radio W10MT3W Metered Variac Autotransformer.

4. Vectorscope. Measuring functions, differential gain and differential phase; accuracy, 0.5% and 0.1° respectively. Tektronix Type 522 PAL Vectorscope recommended.

5. Constant Amplitude Signal Generator. Frequency, to 5 MHz; output amplitude, adjustable from about 0.5 volt to 2 volts; amplitude regulation, within 3%. Tektronix Type 191 Constant Amplitude Signal Generator recommended.

6. Frequency Counter. Frequency DC to 5 MHz. For example, General Radio Model 1191 Counter.

7. Video Signal Source. Tektronix Type 142 recommended.

8. 067-0596-00 Chopped Voltage Reference.[1] Tektronix calibration fixture 067-0596-00.

9. 011-0100-01 Voltage Step Up Termination. Tektronix Part No. 011-0100-01.

10. 015-0149-00 Return Loss Bridge. Tektronix Part No. 015-0149-00.

11. Probe. Attenuation, 10X; connector, BNC. Tektronix Probe, P6008 Part No. 010-0219-00 recommended (supplied with Tektronix Type 547 oscilloscope).

[1] **See "NOTE" following step 6, part g, of procedure.**

12. Probe. Attenuation, 1X; connector, BNC. Tektronix Probe, P6028 Part No. 010-0074-00 recommended.

13. Cable (six). Impedance, 75 ohm; length, 42 inches; connectors, BNC. Tektronix Part No. 012-0074-00.

14. Cable. Impedance, 50 ohm; length, 5 ns; connectors, GR. Tektronix Part No. 017-0502-00 (supplied with Tektronix Type 191).

15. Termination (three). Impedance, 75 ohm; connectors, BNC; type, end-line; accuracy, within 3%. Tektronix Part No. 011-0102-00.

16. Termination. Impedance, 75 ohm; connectors, BNC; type, feed-through; accuracy, within 0.2%. Tektronix Part No. 011-0103-02 (supplied with Tektronix Type 142).

17. Termination (two). Impedance, 75 ohm; connectors, BNC; type, feed-through; accuracy, within 0.2% and matched to within 0.2%. Tektronix Part No. 011-0103-00 and 011-0103-01 (supplied with Tektronix calibration fixture 015-0149-00).

18. Attenuator. Impedance, 50 ohm to 75 ohm; connectors, BNC; type, minimum loss going from a 50 ohm system to a 75 ohm system. Tektronix Part No. 011-0057-00.

19. Adapter. Connectors, BNC Male to GR. Tektronix Part No. 017-0064-00.

20. Adapter. Connectors, BNC-T. Tektronix Part No. 103-0030-00.

21. Jumper Wire. Length, 3 inches; connectors, small insulated alligator clips. To be obtained locally.

22. Adjustment Tools

Description	Tektronix Part No.
a. Tuning tool:	
Handle; nylon	003-0307-00
Insert; 0.077-inch diameter for 5/64-inch hex cores.	003-0310-00
b. Rod; 5-inches long, plastic, for 0.100-inch diameter powered iron hex cores.	003-0301-00
c. Adjustment tool; 1 1/2-inch shaft, 5 inches total length, plastic shaft, and handle, with metal screwdriver tip.	003-0000-00
d. Screwdriver; 3/32-inch diameter round shank, 5 inches long with plastic handle.	003-0192-00

CALIBRATION RECORD AND INDEX

This short-form calibration procedure is provided to aid in checking the operation of the Type 142. It may be used as a calibration guide by the experienced calibrator, or it may be used as a record of calibration. Since the step numbers and titles used here correspond to those used in the complete procedure, this procedure also serves as an index to locate a step in the complete procedure. Performance requirements listed are not instrument specifications unless they correspond to those given in the Specification Section.

Type 142

Calibration Date ________________

Calibrated By _________________

1. Adjust Regulated Power Supplies Page 5-7

Requirement: −15 volts within 3%.

+3.6 volts within 3%.

+10 volts within 3%

2. Check Power Supply Regulation and Ripple Page 5-7

Requirement: −15 volts; 10 mV peak to peak or less.

+3.6 volts; 10 mV peak to peak or less.

+10 volts; 10 mV peak to peak or less.

3. Check/Adjust Subcarrier Oscillator Frequency — Page 5-9

Requirement: 3.575611 MHz within 5 Hz.

4. Check/Adjust Subcarrier Amplitude — Page 5-10

Requirement: 2 volts peak to peak within 0.2 volt.

5. Check Subcarrier Phase Control — Page 5-10

Requirement: One complete revolution will cause a corresponding revolution of the vectorscope display.

6. Check/Adjust Luminance Amplifier — Page 5-12

Requirement: 700 mV within 1% between blanking and white level.

7. Check/Adjust Sync Amplitude — Page 5-13

Requirement: 300 mV within 1% between blanking and sync tip.

8. Check/Adjust Luminance Amplifier DC Balance — Page 5-14

Requirement: 0 volts within 50 mV.

9. Check Variable APL Amplitude — Page 5-14

Requirement: 70 mV within 2%, each step.

10. Check/Adjust Bar Width — Page 5-16

Requirement: Between 6.3 and 6.9 μs.

11. Check Split Field Operation — Page 5-16

Requirement: Display should consist of color bar display for approximately 11.5 ms followed by color bar luminance display for approximately 3.8 ms each field.

12. Adjust U and V Modulator Filters — Page 5-17

Requirement: See complete procedure.

13. Check/Adjust U and V Quad Phase and Carrier Balance — Page 5-19

Requirement: See complete procedure.

14. Check/Adjust Phase Switcher — Page 5-19

Requirement: U and V axis dots must overlay within 0.5° on each axis as measured on a vectorscope.

15. Check/Adjust Modulator Phasing — Page 5-20

Requirement: Displays must overlay within 10 mV using a Voltage Step Up Termination.

16. Adjust Spurious Subcarrier — Page 5-21

Requirement: 3.57 MHz aberration between burst and the first color bar must be less than or equal to 32 mV peak to peak.

17. Check Spurious Output — Page 5-22

Requirement: Aberration at center of sync tip must be less than or equal to 32 mV peak to peak.

18. Adjust Modulator Output Filter — Page 5-22

Requirement: See complete procedure.

19. Check/Adjust Chrominance Amplifier — Page 5-24

Requirement: 600 mV within 3%.

20. Check APL Subcarrier Modulation and Duration — Page 5-25

Requirement: See complete procedure.

21. Check Chrominance Amplitudes — Page 5-26

Requirement: See complete procedure.

22. Adjust Chrominance Amplitudes — Page 5-28

Requirement: See complete procedure.

23. Check/Adjust Burst Amplitude — Page 5-31

Requirement: 300 mV peak to peak within 3% total; U, 212 mV peak to peak within 3%; V, 212 mV peak to peak within 3%.

24. Check/Adjust Setup (Black) Level — Page 5-32

Requirement: 50 mV within 1%.

25. Check/Adjust Color Bar Luminance Levels — Page 5-32

Requirement: See complete procedure.

26. Check/Adjust Full Field White Risetime and Duration — Page 5-34

Requirement: Aberrations, less than or equal to 2% of a 5 cm display amplitude; risetime, 115 ns within 15%.

27. Check/Adjust Luminance to Chrominance Delay — Page 5-34

Requirement: Within 20 ns.

28. Check Chrominance Risetime — Page 5-35

Requirement: 375 ns within 15%.

29. Check/Adjust Staircase Level Amplitudes — Page 5-35

Requirement: 140 mV within 1% between steps; 700 mV within 1% between blanking level and peak.

30. Check/Adjust Staircase Risetime and Aberrations — Page 5-38

Requirement: Aberrations, less than or equal to 2% of a 5 cm display; risetime, 260 ns within 15%.

31. Check/Adjust Staircase Modulation — Page 5-38

Requirement: 140 mV peak to peak within 3%.

32. Check Staircase Modulation Duration — Page 5-39

Requirement: 39 µs within 5%.

33. Check/Adjust Line Timing — Page 5-40

Requirement: See Table 5-5 and Table 5-6.

34. Check Bruch and NTSC Sequence — Page 5-41

Requirement: See complete procedure.

35. Check VITS — Page 5-43

Requirement: Component, color bar or staircase; placement, must be on correct line and field as determined by front panel controls.

36. Check/Adjust Output Amplifiers — Page 5-43

Requirement: See complete procedure.

37. Check/Adjust Convergence Amplitudes — Page 5-44

Requirement: Overall, 1 volt peak to peak within 5%; blanking level to peak, 700 mV within 5%; sync, 300 mV within 5%; setup, 50 mV within 5%.

38. Check/Adjust Crosshatch Vertical lines — Page 5-45

Requirement: Number of pulses, 17 each line; positioning, at least 3.2 µs; width of pulse, 225 ns within 15%; width of dot pulse, 350 ns within 15%.

39. Check Crosshatch Horizontal Lines — Page 5-47

Requirement: Number of pulses, 14 per field; positioning, at least 1.1 ms.

40. Check/Adjust Convergence Risetime — Page 5-47

Requirement: 115 ns within 10%.

41. (Calibration Procedure Only) Check Instrument Return Loss — Page 5-48

Requirement: See complete procedure.

42. Check Jitter — Page 5-50

Requirement: 4 ns or less.

43. Adjust External Sync Position — Page 5-50

Requirement: See complete procedure.

44. Check External Inputs — Page 5-50

Requirement: See complete procedure.

45. Check Passive Isolation — Page 5-51

Requirement: See complete procedure.

46. (Calibration Procedure Only) Check Active Isolation — Page 5-52

Requirement: See complete procedure.

47. Check Diff Gain and Diff Phase Page 5-53

Requirement: Diff Gain, less than or equal to 0.5%; Diff Phase, 0.1° or less.

48. Check V Axis Phasing Page 5-54

Requirement: See complete procedure.

PERFORMANCE CHECK/ CALIBRATION PROCEDURE

General

The following procedure is arranged in a sequence designed for checking or calibration with minimum interaction of adjustments and reconnection of equipment. However, some adjustments affect the calibration of other circuits within the instrument, and it may be necessary to check the operation of other parts of the instrument. When a step interacts with others, the steps which need to be checked are noted in the "INTERACTION" step.

NOTE

If adjustments are made on the power supplies, the calibration of the entire instrument should be checked.

Do not preset internal controls unless the instrument has been repaired, or is known to be seriously out of adjustment. If repairs have been made, preset internal controls to midrange in the affected circuits.

Steps titled "CHECK" or "CHECK/ADJUST" are a combined Performance Check and Calibration procedure. (Exception: steps 41 and 46 are calibration procedure only.) When performing a Performance Check only, do not do the "ADJUST" portion of the step. Steps titled "ADJUST" are used only with a complete Calibration of the instrument.

The symbol ◐ is used to identify the steps in which an adjustment is made. To prevent recalibration of other circuits when performing a partial calibration, readjust only if the listed tolerance is not met. When performing a complete calibration, best overall performance will be provided if each adjustment is made to the exact setting.

In the following procedure, a test equipment setup picture is shown for each major group of adjustments and checks. Near each setup picture is a list of front-panel control settings for equipment which needs to be changed from those given following Fig. 5-1. Since several controls may have changed during a step or group of steps, when performing a partial calibration or performance check, always start with that step following a setup picture. Type 142 front-panel and rear-panel control titles and output connectors are capitalized (e.g., COMP SYNC). Internal adjustment titles are initial capitalized only (e.g., Bar Width). Unless stated otherwise, all connections are made to the Type 142 front-panel connectors.

The following procedure uses the equipment and fixtures previously listed in this section of the manual. If equipment and fixtures are substituted, control settings of test equipment setup may need to be altered to meet the requirements of the equipment used.

NOTE

All waveforms shown in this procedure are actual photographs taken with a Tektronix Oscilloscope Projected Graticule Camera System.

Preliminary Procedure

1. (Calibration Procedure only) Remove the Type 142 from any enclosure so as to provide access to all internal adjustments and test points, including rear-panel connectors. (Exception: see Steps 27 and 28.)

2. (Calibration Procedure only) Lay the Type 142 on its side for access to the Power Supply board.

3. Connect the autotransformer to a suitable power source and the Type 142 to the autotransformer output.

4. Set the autotransformer output voltage to the design center voltage for which the Type 142 LINE VOLTS selector switch has been set.

5. Set the Type 142 POWER switch to ON. Allow at least 20 minutes warmup at 25°C, ±5°C before checking and/or calibrating the instrument to the given accuracy.

6. Set the Type 142 and test equipment controls as described following Fig. 5-1.

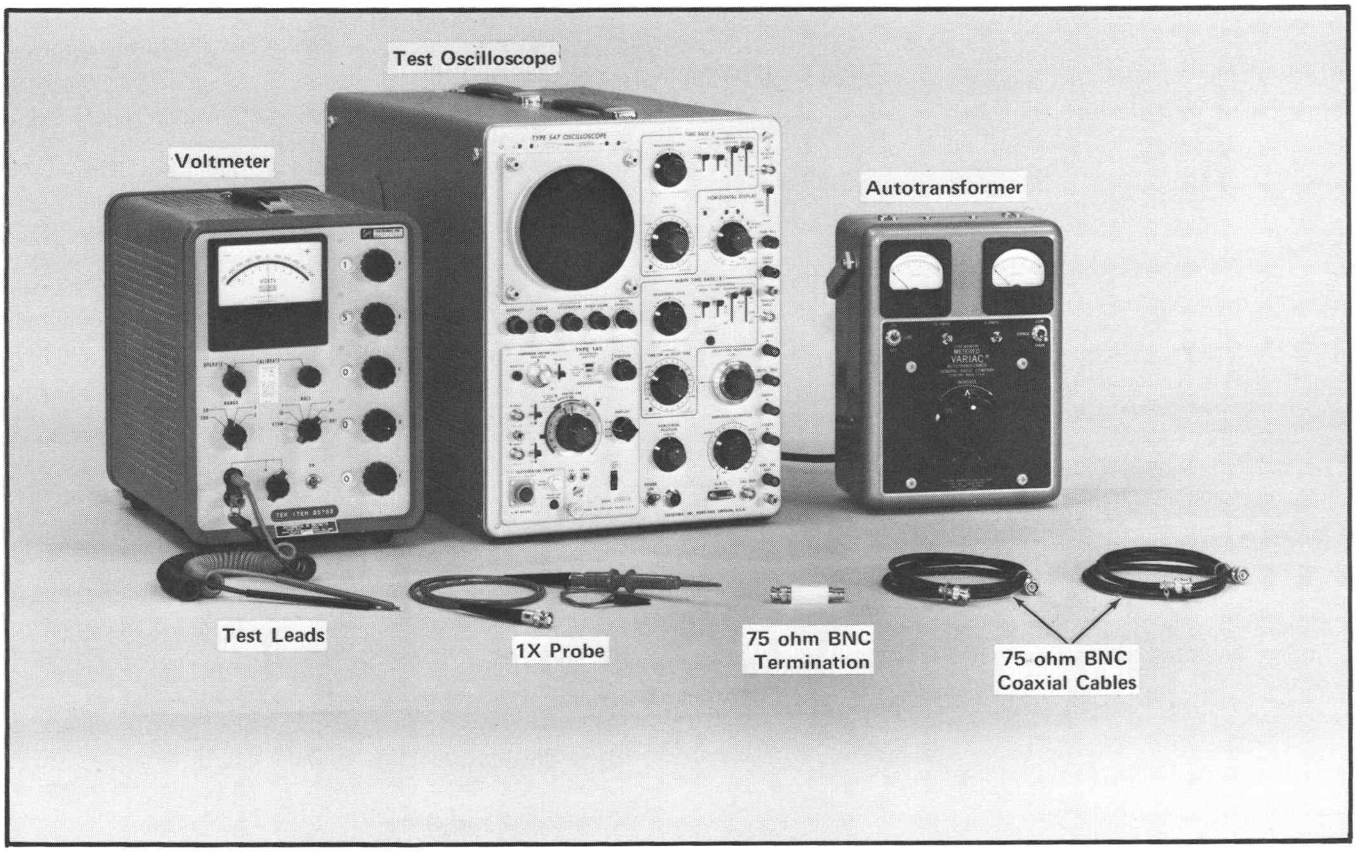


Fig. 5-1. Test equipment required for steps 1 and 2.

Type 142 Controls

BURST	
U	Up
V	Up
COLOR BAR	
U	Up
V	Up
Y	Up
WHITE REF	100%
AMPL	75%
FULL FIELD	Up
MOD STAIRCASE	
U SUBCARRIER	Up
STEPS	Down
V SUBCARRIER	OFF
APL%	0/50
VITS	
FIELD	1 and 3
TEST SIGNAL	MOD STAIRCASE
LINES	12/275
CONVERGENCE	
CROSSHATCH	On
DISPLAY	CROSSHATCH
VERT POSITION	Midrange
HORIZ POSITION	Midrange
SYNCHRONIZATION	
V AXIS PHASING	90°/270°
BURST BLANKING	BRUCH SEQ
TEST SIGNAL	COMP
REF	INT
SUBCARRIER PHASE	As desired
POWER	ON

Test Oscilloscope Controls

Viewing	
Intensity	As desired
Focus	As desired
Astigmatism	As desired
Scale Illum	As desired
Trace Separation	0
Time Base A	
Triggering Level	Near 0, pushed in
Triggering	
Mode	Trig
Slope	—
Coupling	DC
Source	Ext
Time/Cm	20 μs
Variable (Time/Cm)	Calibrated
Time Base B	Not used
Horizontal Display	A
Sweep Magnifier	Off
Single Sweep	Normal
Delay-Time Multiplier	Not used

Horizontal Position	Midrange
Vernier (Horizontal Position)	Midrange
Power	On
Amplitude Calibrator	Off
Vertical Amplifier (Type 1A5)	
A Input AC-GND-DC	GND
B Input AC-GND-DC	GND
Volts/Cm	.2 V
Variable (Volts/Cm)	Cal
Display	A-Vc
Position	Midrange
Step Atten Bal	As is
Comparison Voltage	
Amplitude	0-0
Polarity	0

1. Adjust Regulated Power Supplies

a. Test equipment is shown in Fig. 5-1.

b. Connect the common lead of the voltmeter to a convenient chassis ground point on the Type 142. Then, connect the positive lead to the junction of R887 and C885 (−15 volts) on the Power Supply board (see Fig. 5-2).

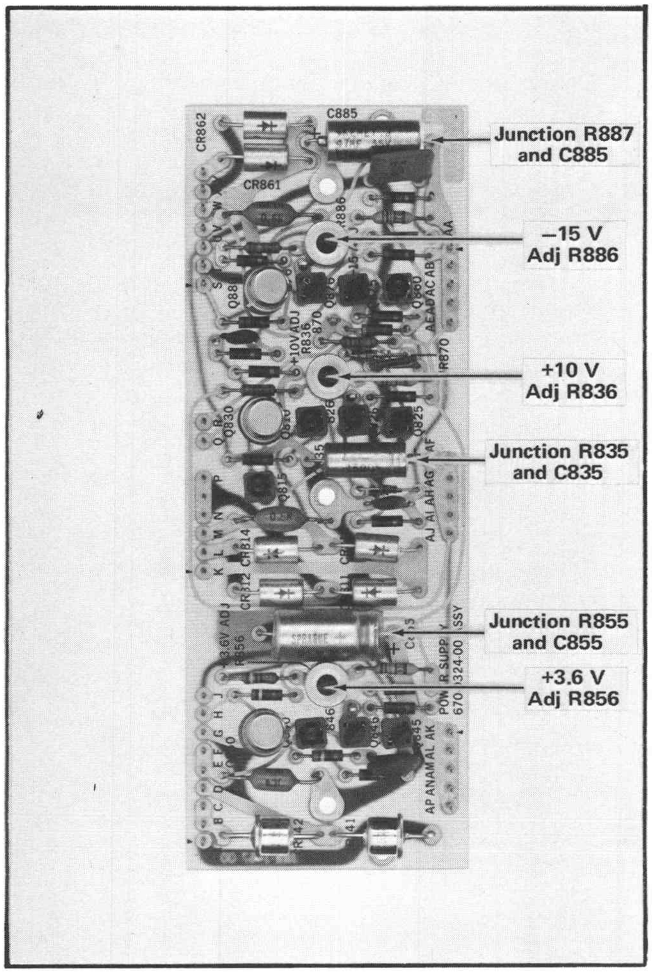


Fig. 5-2. Power Supply board test point and adjustment locations.

c. CHECK—Voltmeter reading; must be −15 volts within 3%.

d. ADJUST—−15 Volt Adj, R886, for a voltmeter reading of −15 volts.

e. Disconnect the voltmeter lead from the junction of R887 and C885 and reconnect it to the junction of R855 and C855 (+3.6 volts).

f. CHECK—Voltmeter reading; must be +3.6 volts within 3%.

g. ADJUST—+3.6 Volt Adj, R856, for a voltmeter reading of +3.6 volts.

h. Disconnect the voltmeter lead from the junction of R855 and C855 and reconnect it to the junction of R835 and C835 (+10 volts).

i. CHECK—Voltmeter reading; must be +10 volts within 3%.

j. ADJUST—+10 Volt Adj, R836, for a voltmeter reading of +10 volts.

k. Repeat parts b through j to remove any interaction of adjustments.

l. Disconnect the voltmeter.

m. INTERACTION—May affect the operation of other circuits.

2. Check Power Supply Regulation and Ripple

NOTE

Tolerances for this step are not instrument specifications; rather, they are guides to determine whether complete instrument calibration is needed.

a. From the Type 142 TEST SIGNAL connector, connect a 75 ohm coaxial cable and a 75 ohm termination to the Type 1A5 A Input connector.

b. From the Type 142 rear-panel HORIZ DRIVE connector, connect a 75 ohm coaxial cable to the test oscilloscope Time Base A Trigger Input connector.

c. Set the Type 1A5 A Input AC-GND-DC switch to DC.

d. Set the test oscilloscope Time Base A Trigger Level control for a triggered display, and the viewing controls for a sharply focused and well defined display.

e. Rotate the test oscilloscope Horizontal Position control and the Type 1A5 Position control to center the display on the test oscilloscope.

f. Set the Type 1A5 Volts/Cm switch to .1 V and the Variable (Volts/Cm) control for a display amplitude of 6 cm, as measured on the test oscilloscope, between the most positive and most negative excursions of the display.

g. CHECK—Test oscilloscope display; note stability and amplitude.

h. Set the autotransformer output voltage to the lower voltage listed for the LINE VOLTS selector position being used.

i. CHECK—Test oscilloscope display; amplitude and/or stability of the display must not have changed from that noted in part g.

j. Set the autotransformer output voltage to the higher voltage listed for the LINE VOLTS selector position being used.

k. Repeat part i. Then, return the autotransformer output voltage to the design center voltage listed for the LINE VOLTS selector position being used.

NOTE

For Performance Check, proceed to part u.

l. Set the Type 1A5 Input AC-GND-DC switch to GND, B Input AC-GND-DC switch to AC, Volts/Cm switch to 2 mV, Variable (Volts/Cm) control to Cal, and the Display switch to Ac-B.

m. Set the test oscilloscope Time Base A Time/Cm switch to 5 ms and the Triggering Switches to Auto, +, AC, and Line.

n. From the Type 1A5 B Input connector, connect a 1X probe to the junction of R887 and C885 (−15 V) on the Type 142 Power Supply board; see Fig. 5-2.

o. CHECK—Test oscilloscope display; amplitude must be 10 mV peak to peak or less.

p. Repeat parts (in listed order) h, o, j, and o.

q. Disconnect the 1X probe from the junction of R887 and C885 and reconnect it to the junction of R855 and C855 (+3.6 V).

r. Repeat parts (in listed order) o, h, and o.

s. Disconnect the 1X probe from the junction of R855 and C855 and reconnect it to the junction of R835 and C835 (+10 V).

t. Repeat parts (in listed order) o, j, and o.

u. Disconnect all test equipment; connect the Type 142 directly to a suitable power source.

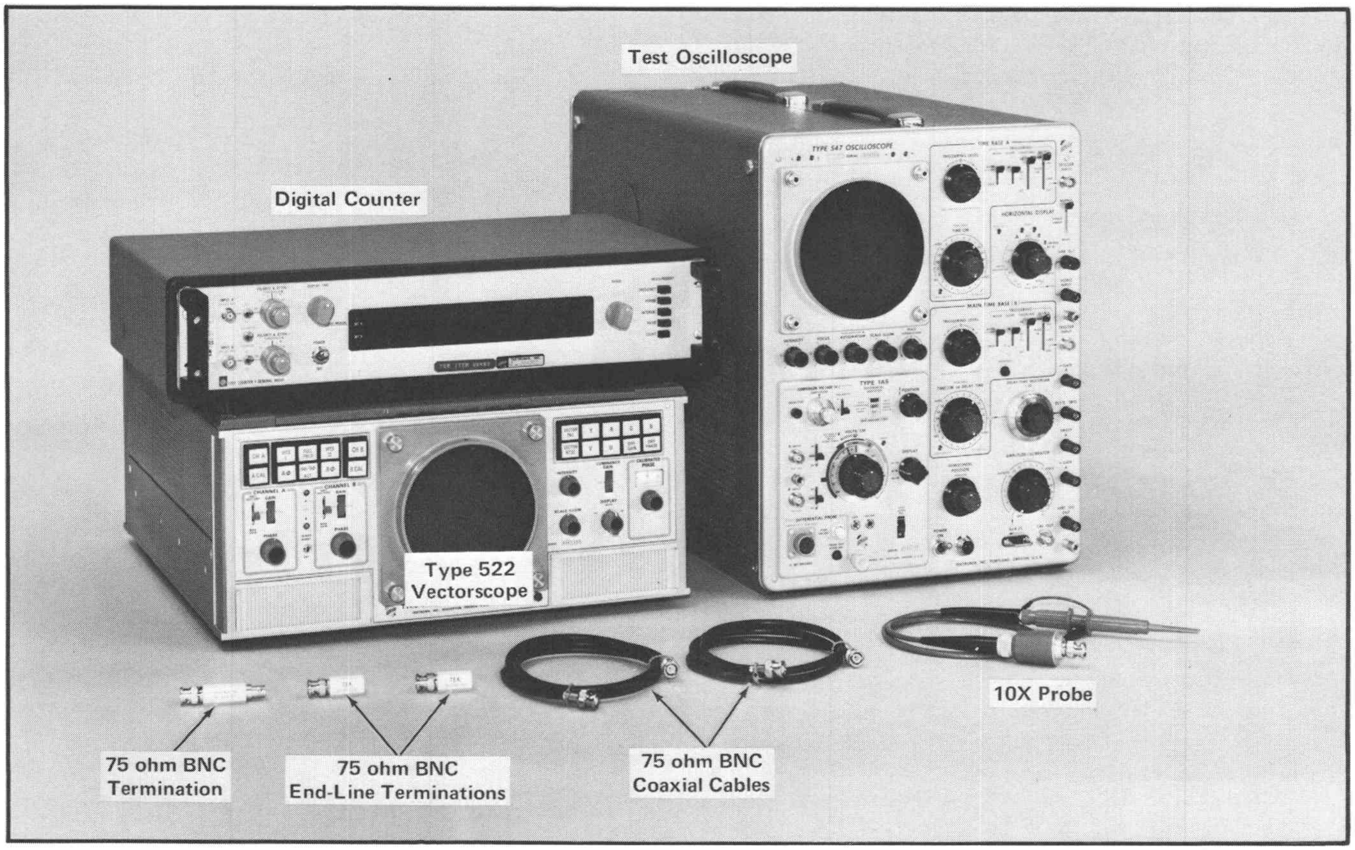


Fig. 5-3. Test equipment required for steps 3 through 5.

Type 142 Control

MOD STAIRCASE STEPS	Up

Test Oscilloscope Controls

Time Base A	
Triggering Level	Near 0, pushed in
Triggering	
Mode	Trig
Slope	—
Coupling	DC
Source	NORM
Time/Cm	.1
Vertical Amplifier (Type 1A5)	
A Input AC-GND-DC	DC
B Input AC-GND—DC	AC
Volts/Cm	.5 V
Display	A-Vc

Frequency Counter Controls

Set so that a 2 V peak to peak 3.575611 MHz signal may be counted.

Vectorscope Controls

Signal Selector	CH A, Full Field, AΦ
Channel A	
100%-75%-Max Gain	75%
Gain	As is
Phase	As is
A Cal	Cal
Channel B	Not used
Φ Ref	Ext
Function Selector	Vector PAL
Intensity	As desired
Luminance Gain	Cal
Display	Both
Scale Illum	As desired
Calibrated Phase	0
Power	On
Left recessed front-panel controls	As is
Right recessed front-panel controls	As is

3. Check/Adjust Subcarrier Oscillator Frequency

a. Test equipment is shown in Fig. 5-3. To determine the Type 142 and test oscilloscope control settings, first refer to the partial list that precedes this step and then, for the remaining controls, refer to the list that follows Fig. 5-1.

b. CHECK—Type 142 OVEN LIGHT; light must be on, indicating correct oven heater operation.

c. From the Type 142 SUBCARRIER connector, connect a 75 ohm coaxial cable and a 75 ohm termination to the Digital Frequency Counter Input connector.

d. CHECK—Frequency counter; 3.575611 MHz, ±5 Hz.

e. ADJUST—R1195, see Fig. 5-4, for 3.575611 MHz.

4. Check/Adjust Subcarrier Amplitude

a. Disconnect the 75 ohm termination from the Frequency Counter Input connector and connect it to the Type 1A5 A Input connector.

b. Set the test oscilloscope Triggering Level control for a triggered display.

c. CHECK-Test oscilloscope display amplitude; must be 2 volts peak to peak within 0.2 volt.

d. Disconnect the 75 ohm coaxial cable from the Type 142 SUBCARRIER connector, and reconnect it to the rear-panel SUBCARRIER connector.

e. Repeat part c.

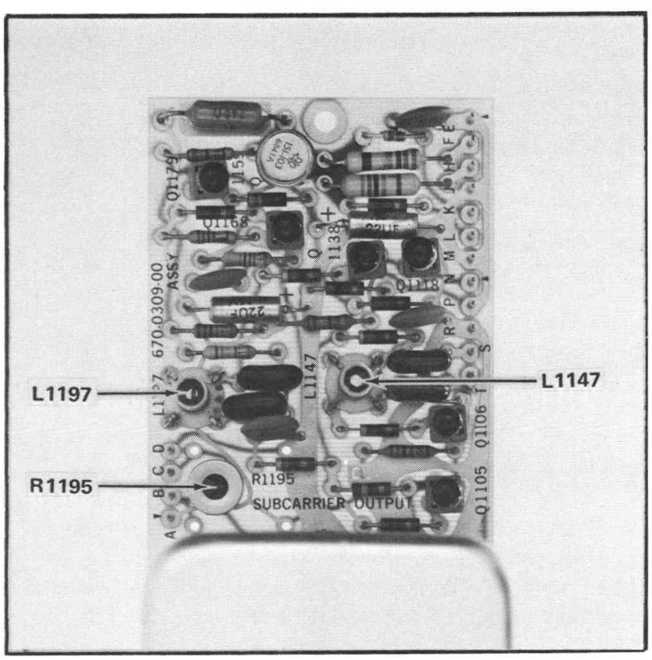


Fig. 5-4. Subcarrier Output board adjustment.

NOTE

For Performance Check proceed to part m.

f. From the Type 1A5 B Input connector, connect a 10X probe to TP674 on the Type 142 Line Timing board (see Fig. 5-5).

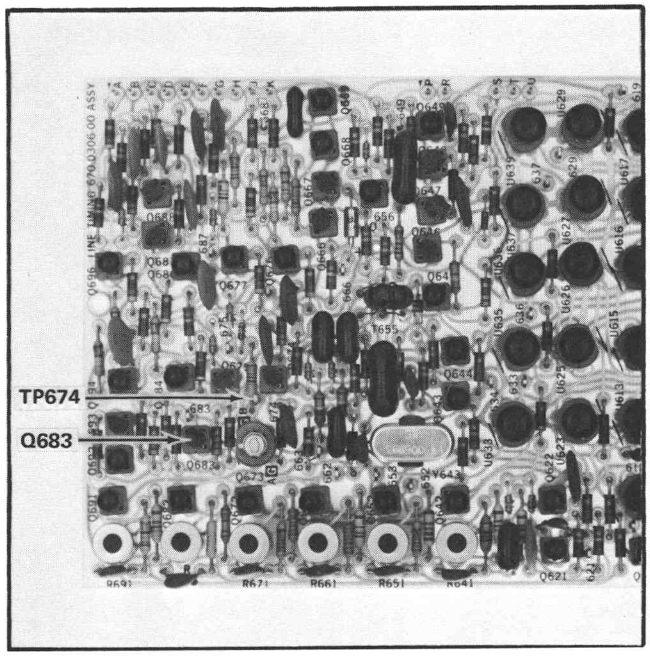


Fig. 5-5. Line Timing board test point and transistor locations.

g. Set the Type 1A5 Display Switch to Vc-B, and the Volts/Cm switch to 50 mV.

h. ADJUST—L1147 (see Fig. 5-4) for maximum signal amplitude as measured on the test oscilloscope.

i. Set the Type 1A5 Volts/Cm switch to .5 V and the Display Switch to A-Vc.

j. ADJUST—L1197 for a signal amplitude of 2 volts peak to peak within 0.2 volt as measured on the test oscilloscope.

k. Disconnect the test equipment and connections.

5. Check Subcarrier Phase Control

a. Connect a 75 ohm end-line termination to the Type 522 PAL Vectorscope Channel A J2 connector and another 75 ohm end-line termination to the Ext CW Φ REF J311 connector.

b. Connect a 75 ohm coaxial cable from the Type 142 rear-panel SUBCARRIER connector to the Vectorscope Ext CW Φ REF J310 connector and another 75 ohm coaxial cable from the Type 142 TEST SIGNAL connector to the Vectorscope Channel A J1 connector.

c. Observing the Vectorscope display, rotate the Type 142 SYNCHRONIZATION SUBCARRIER PHASE control clockwise one revolution.

d. CHECK—Vectorscope display; display must rotate one complete revolution.

NOTE

Tolerances for this step are not instrument specifications.

e. Repeat parts c and d, this time rotating the control in a counterclockwise direction.

f. Disconnect all test equipment and connections.

NOTES

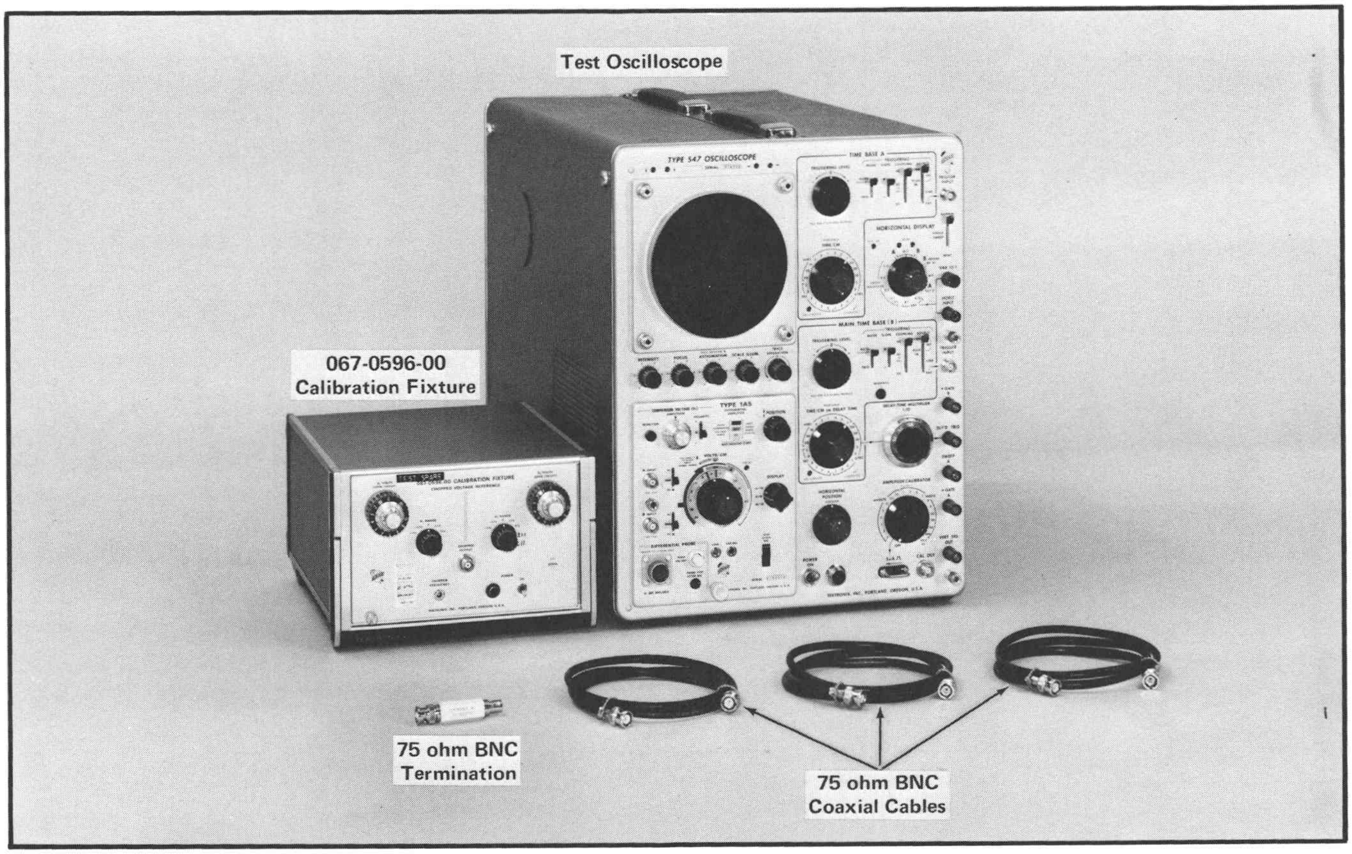


Fig. 5-6. Test equipment required for steps 6 through 11.

Type 142 Controls

FULL FIELD	Down
MOD STAIRCASE	
U SUBCARRIER	Down
STEPS	Down

Test Oscilloscope Controls

Time Base A	
Trigger Level	In minus region, pushed in
Triggering Source	Ext
Time/Cm	10 µs
Vertical Amplifier (Type 1A5)	
A Input AC-GND-DC	DC
B Input AC-GND-DC	DC
Volts/Cm	0.2
Display	A-B

067-0596-00 Calibration Fixture Controls

V_1	
Range	0
Volts	0-0-0
V_2	
Range	+1.1 V
Volts	5-0-0
Chopper Frequency	As is
Power	On

6. Check/Adjust Luminance Amplifier Gain ⓵

a. Test equipment is shown in Fig. 5-6. To determine the Type 142 and test oscilloscope control settings, first refer to the partial list that precedes this step and then, for the remaining controls, refer to the list that follows Fig. 5-1.

b. From the Type 142 TEST SIGNAL connector, connect a 75 ohm coaxial cable and a 75 ohm termination to the Type 1A5 A Input connector.

c. From the Type 142 rear-panel HORIZ DRIVE connector, connect a 75 ohm coaxial cable to the test oscilloscope Time Base A Trigger Input connector.

d. From the 067-0596-00 calibration fixture Chopped Output connector, connector a 75 ohm coaxial cable to the Type 1A5B Input connector.

e. Rotate the test oscilloscope Time Base A Triggering Level control for a triggered display.

NOTE

The test oscilloscope displays will be separated by approximately 2 1/2 major divisions.

f. Set the 067-0596-00 calibration fixture V_2 Volts control to 0-0-0 and note that the displays are superimposed.

g. Set the 067-0596-00 calibration fixture V_2 Volts control for a dial setting of 7-0-28 (700 mV).

NOTE

For the remainder of the Performance Check/Calibration procedure, all dial settings of the 067-0596-00 calibration fixture Volts dial(s) will include an error factor. (Exception: see step 45.) See the 067-0596-00 calibration fixture operation manual for details.

h. Set the Type 142 MOD STAIRCASE APL% switch to 100/90.

i. Observing the test oscilloscope display, rotate the 067-0596-00 calibration fixture V_2 Volts control until the APL line of the lower display and the blanking level of the upper display are aligned as shown in Fig. 5-7A.

j. Set the Type 1A5 Volts/Cm switch to 10 mV; repeat part i.

k. CHECK—067-0596-00 calibration fixture V_2 Volts control dial setting; dial setting must be between 6-9-58 and 7-1-00 (700 mV, ±1%).

l. Rotate the 067-0596-00 calibration fixture V_2 Volts control to a dial setting of 7-0-28.

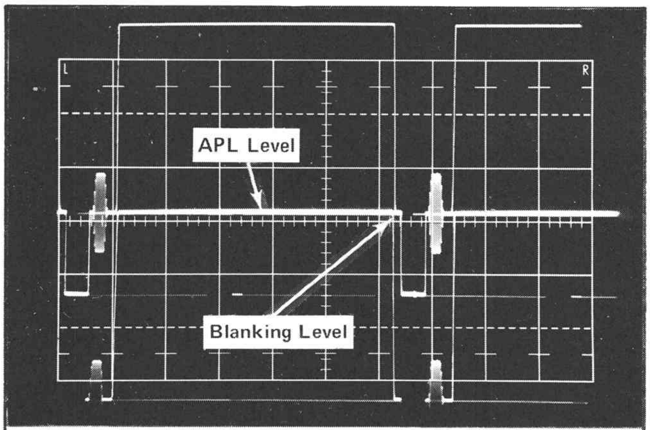
m. ADJUST—Luminance Gain control, R499, (see Fig. 5-8) until the APL level line and the blanking level are aligned.

n. Test equipment remains connected.

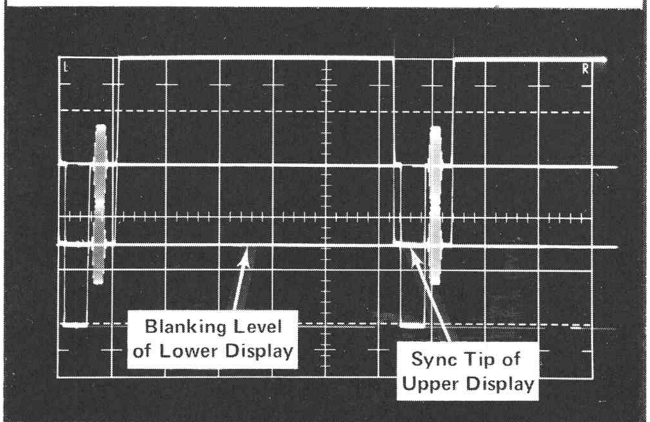
7. Check/Adjust Sync Amplitude

a. Set the Type 1A5 Volts/Cm switch to .2 V.

b. Set the 067-0596-00 calibration fixture V_2 Range switch to −1.1 V and rotate the V_2 Volts control to a dial setting of 3-0-10 (300 mV).



(A) APL level aligned with the blanking level.



(B) Sync tip of upper display aligned with the blanking level of lower display.

Fig. 5-7. Luminance and Sync Amplifiers properly adjusted.

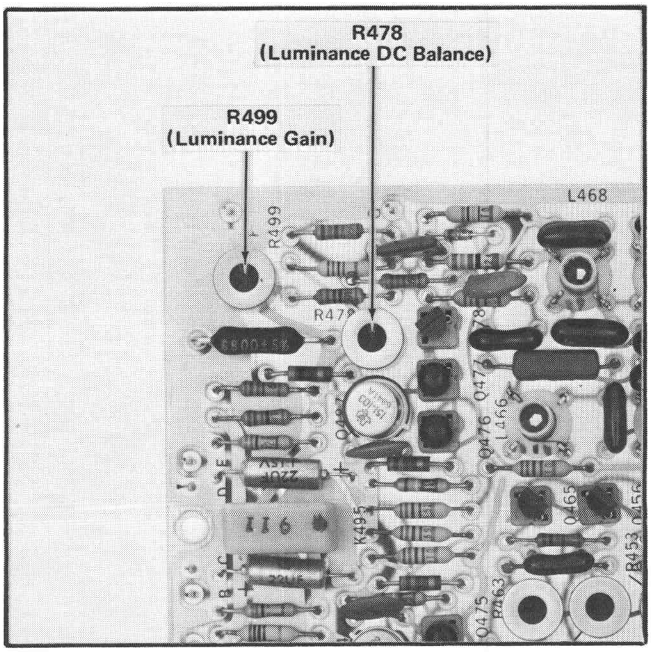


Fig. 5-8. Bar Drive and Video Output board adjustment locations.

c. Observing the test oscilloscope display, rotate the 067-0596-00 calibration fixture V_2 Volts control until the sync tip of the upper display just aligns with the blanking level of the lower display; see Fig. 5-7B.

d. Set the Type 1A5 Volts/Cm switch to 10 mV; repeat part c.

NOTE

Tilt of sync tip is normal using Type 1A5.

e. CHECK—067-0596-00 calibration fixture V_2 Volts control dial setting; dial setting must be between 2-9-80 and 3-0-04 (300 mV, ±1%).

f. Set the 067-0596-00 calibration fixture V_2 Volts control to a dial setting of 3-0-10.

g. ADJUST—Sync Amplitude control, R567, (see Fig. 5-9) until the sync tip just aligns with the blanking level.

h. Test equipment remains connected.

8. Check/Adjust Luminance Amplifier DC Balance

a. Set the Type 1A5 A and B Input AC-GND-DC switches to GND and the Volts/Cm switch to .1 V.

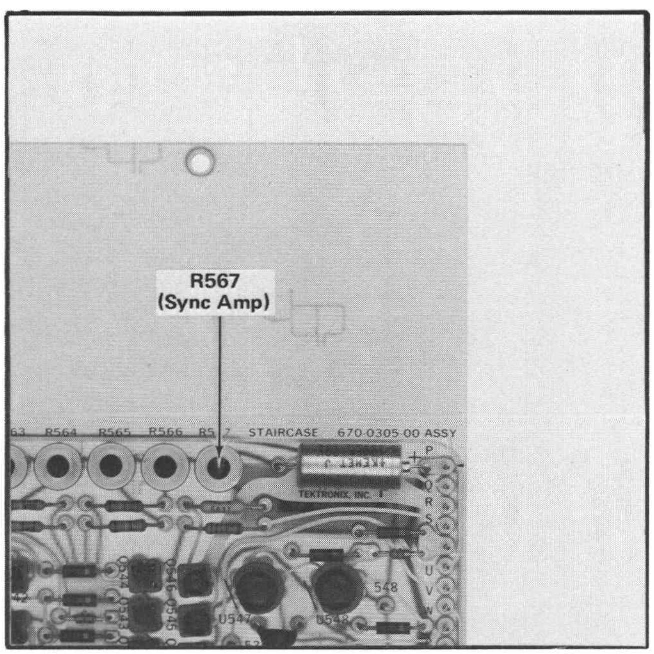


Fig. 5-9. Staircase board adjustment location.

b. Rotate the Type 1A5 Position control to position the trace to the center graticule line on the test oscilloscope.

c. Set the Type 1A5 A Input AC-GND—DC switch to DC.

d. CHECK—Test Oscilloscope display; blanking level of the display must be within 50 mV of the reference established in part b of this step.

e. ADJUST—Luminance DC Bal control, R478, (see Fig. 5-8) until the blanking level of the display exactly coincides with the reference established in part b of this step.

f. INTERACTION—Repeat steps 6, 7, and 8 through 8e.

g. Test equipment remains connected.

9. Check Variable APL Amplitude

NOTE

If any portion of step 9 is not within the listed tolerance, check and/or replace the APL Level resistor(s); see Diagram 5. Then perform steps 6, 7, and 8 before repeating step 9.

a. Set the Type 142 MOD STAIRCASE APL% switch to 0/50.

b. Set the 067-0596-00 calibration fixture V_2 Volts control to 0-0-0.

c. Set the Type 1A5 B Input AC-GND-DC switch to DC, Volts/Cm switch to 10 mV, and rotate the Position control to position the blanking level of the display to the center graticule line on the test oscilloscope.

d. Set the 067-0596-00 calibration fixture V_2 Volts control to approximately 0-7-02.

e. Set the Type 142 MOD STAIRCASE APL% switch to 10/18.

f. Set the Type 1A5 Position control fully counterclockwise.

g. Observing the test oscilloscope display, rotate the 067-0596-00 calibration fixture V_2 Volts control until the blanking level is aligned with the 10 APL level as shown in Fig. 5-10.

h. CHECK—067-0596-00 calibration fixture V_2 Volts control dial setting; must be between 0-6-88 and 0-7-16 (70 mV, ±2%).

i. Set the 067-0596-00 calibration fixture V_2 Range switch to 0, V_1 Range switch to +1.1 V and V_1 Volts control to approximately 0-7-02.

j. Set the Type 1A5 Position control to approximately midrange.

k. Observing the test oscilloscope display, rotate the 067-0596-00 calibration fixture V_1 Volts control until the APL level line (as indicated by the APL% switch setting) is aligned with the blanking level.

l. Set the Type 142 MOD STAIRCASE APL% switch to 20/26.

m. Rotate the Type 1A5 Position control fully counterclockwise.

n. Set the 067-0596-00 calibration fixture V_2 Range switch to −1.1 V.

o. Observing the test oscilloscope display, rotate the 067-0596-00 calibration fixture V_2 Volts control until the blanking level is aligned with the APL level line.

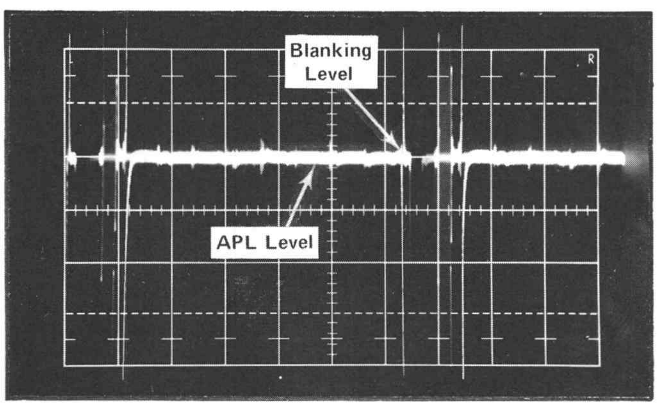


Fig. 5-10. Typical display with APL level aligned with the blanking level.

p. CHECK—067-0596-00 calibration fixture V_2 Volts control dial setting; dial setting must be between 0-6-88 and 0-7-16 (70 mV, ±2%).

q. Set the 067-0596-00 calibration fixture V_2 Range switch to 0 and the V_1 Volts control to approximately 1-4-0.

r. Rotate the Type 1A5 Position control to approximately midrange.

s. Repeat part k.

t. Set the Type 142 MOD STAIRCASE APL% switch to 30/34.

u. Repeat parts m, n, o, and p.

v. Using the procedure just described for checking the 10, 20, and 30 APL% switch settings and Fig. 5-10, check all remaining settings of the Type 142 MOD STAIRCASE APL% switch listed in Table 5-1.

w. Test equipment remains connected.

TABLE 5-1

Set APL switch to:	Type 1A5 Position control	067-0596-00 Calibration Fixture V_1 Range	V_2 Range	V_1 Volts	Repeat part:
NC[2]	Midrange	+1.1 V	0	2-1-36	k
40/42	CCW	NC	−1.1 V		o to p
NC	Midrange	NC	0	2-8-45	k
50/50	CCW	NC	−1.1 V		o and p
NC	Midrange	NC	0	3-5-56	k
60/58	CCW	NC	−1.1 V		o and p
NC	Midrange	NC	0	4-2-66	k
70/66	CCW	NC	−1.1 V		o and p
NC	Midrange	NC	0	4-9-72	k
80/74	CCW	NC	−1.1 V		o and p
NC	Midrange	NC	0	5-6-82	k
90/82	CCW	NC	−1.1 V		o and p
NC	Midrange	NC	0	6-4-02	k
100/90	CCW	NC	−1.1 V		o and p

[2]NC-No change from previous setting.

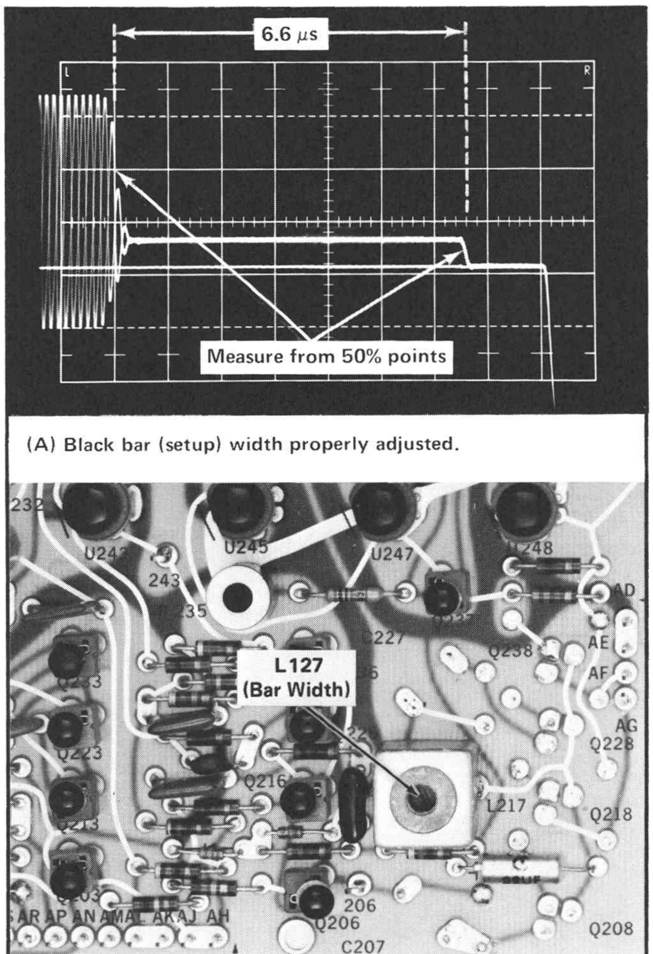
10. Check/Adjust Bar Width

a. Set the Type 1A5 Volts/Cm switch to .1 V, Display switch to A-Vc, B Input AC-GND-DC switch to GND and the Position control to midrange.

b. Set the Type 142 FULL FIELD switch up.

c. Set the test oscilloscope Horizontal Display Sweep Magnifier switch to X10 and rotate the Horizontal Position control to position the start of the black bar (setup) on a major graticule line as shown in Fig. 5-11A.

d. CHECK—Test oscilloscope display, black bar (setup) width must be between 6.3 and 6.9 µs.



(A) Black bar (setup) width properly adjusted.

(B) Bar Timing board adjustment location.

Fig. 5-11. Checking or adjusting bar width.

e. ADJUST—Bar Width control, L217, (see Fig. 5-11B) for a black bar width of 6.6 µs.

f. Test equipment remains connected.

11. Check Split Field Operation

a. Set the Type 142 COLOR BAR U and V switches to SPLIT FIELD; set the MOD STAIRCASE U SUBCARRIER and STEPS switches up.

b. Disconnect the 75 ohm coaxial cable from the Type 142 rear-panel HORIZ DRIVE connector and reconnect it to the rear-panel VERT DRIVE connector.

c. Set the test oscilloscope Time Base A Time/Cm switch to 2 ms, the Sweep Magnifier switch to Off, and the Type 1A5 Volts/Cm switch to .2 V.

d. Set the test oscilloscope Triggering Level control so that a stable display of one field is obtained.

e. CHECK—Test oscilloscope display; the color bar chrominance signal should occupy 11.5 ms of the field (see Fig. 5-12). The last active lines (3.8 ms) of the field should contain only the luminance portion of the color bar signal.

f. Disconnect all test equipment.

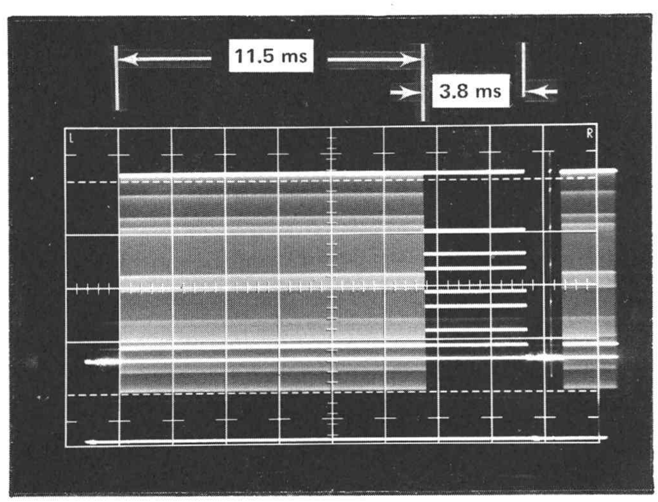


Fig. 5-12. Typical display to check split field operation.

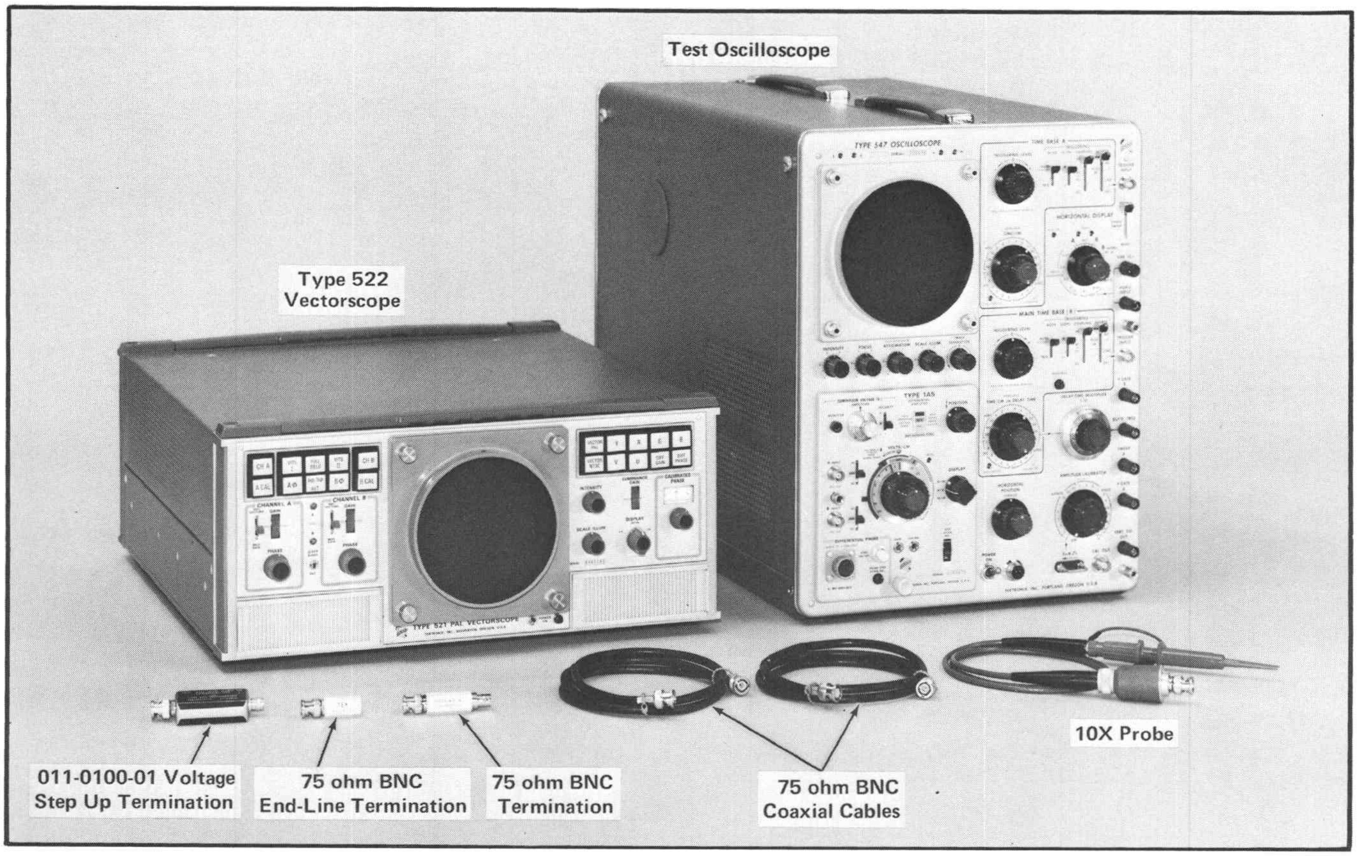


Fig. 5-13. Test equipment required for steps 12 through 18.

Type 142 Controls

MOD STAIRCASE APL%	0/50

Test Oscilloscope Controls

Time/Cm
Vertical Amplifier (Type 1A5)

Time Base A	
Time/Cm	10 μs
Vertical Amplifier (Type 1A5)	
A Input AC-GND-DC	AC
Volts/Cm	5 mV

Vectorscope Controls

Signal Selector	CH A, FULL FIELD Φ
Channel A	
100%-75%-MAX'GAIN	75%
Gain	As is
Phase	As is
A Cal	Cal
Channel B	Not used
Φf	Φ Ref Burst
Function Selector	Vector PAL
Intensity	As desired
Luminance Gain	Cal
Display	Both
Scale Illum	As desired
Calibrated Phase	0
Power	On
Left recessed front-panel controls	As is
Right recessed front-panel controls	As is

12. Adjust U and V Modulator Filters

a. Test equipment is shown in Fig. 5-13. To determine the Type 142 and test oscilloscope control settings, first refer to the partial list that precedes this step and then for the remaining controls, refer to the list that follows Fig. 5-1.

b. Connect a properly compensated 10X probe to the Type 1A5 A Input connector.

c. From the Type 142 rear-panel COMP BLANKING connector, connect a 75-ohm coaxial cable to the test oscilloscope Time Base A Trigger Input connector.

d. Connect the 10X probe tip to TP188 on the Modulator board (see Fig. 5-14).

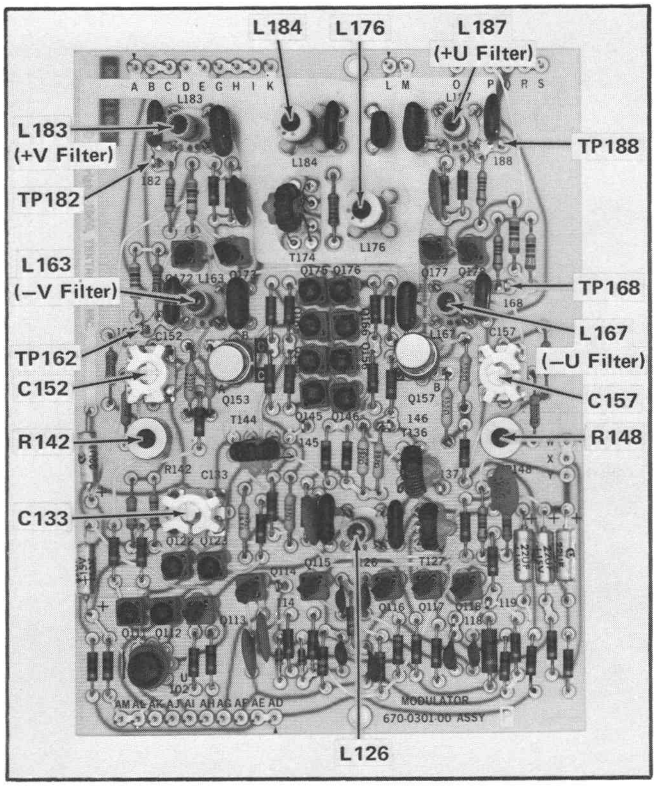


Fig. 5-14. Modulator board adjustment and test point locations.

e. ADJUST—+U Filter, L187, for the best square corner on the leading edges of the display as shown in Fig. 5-15A.

f. Disconnect the 10X probe from TP188 and reconnect it to TP168.

g. ADJUST—–U Filter, L167, for the best square corner on the leading edges of the display as shown in Fig. 5-15B.

h. Disconnect the 10X probe from TP168, set the Type 1A5 Volts/Cm switch to 10 mV, and then reconnect the probe to TP182.

i. ADJUST—+V Filter, L183, for the best square corner on the leading edges of the display as shown in Fig. 5-15C.

j. Disconnect the 10X probe from TP182 and reconnect it to TP162.

k. ADJUST—–V Filter, L163, for the best square corner on the leading edges of the display as shown in Fig. 5-15D.

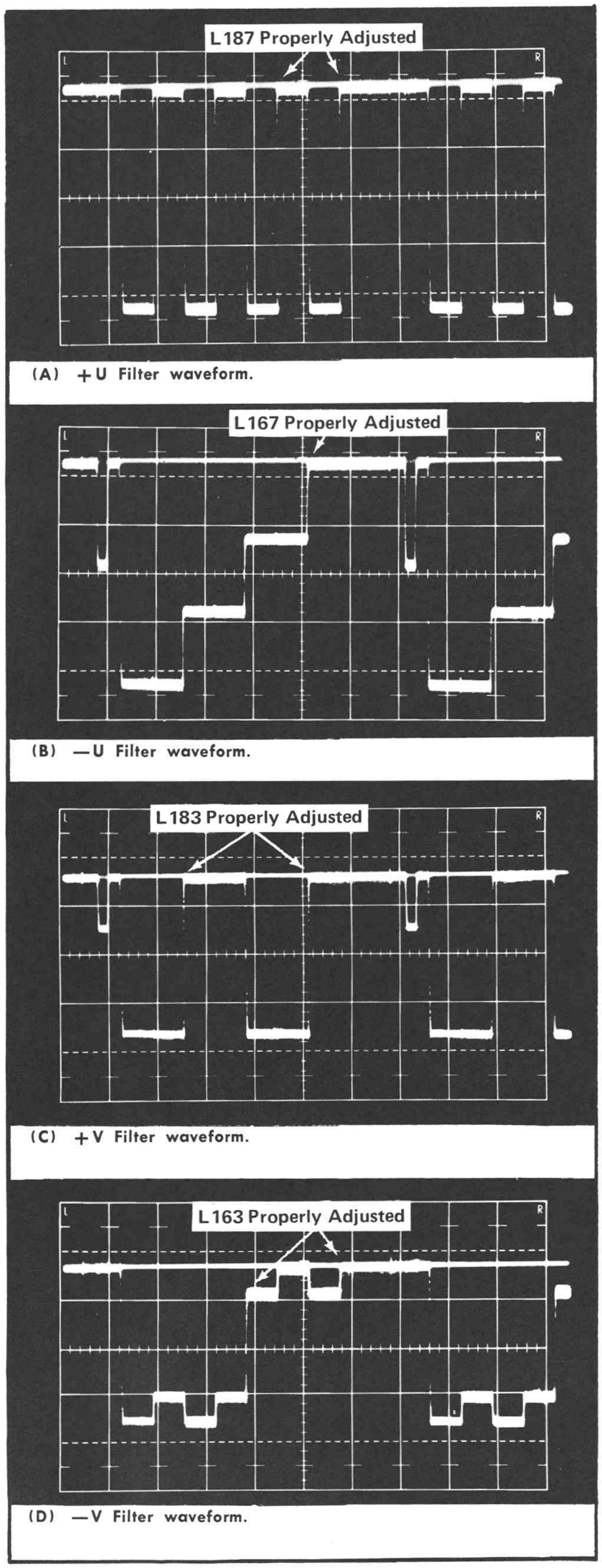


Fig. 5-15. Typical U and V Filter waveforms.

l. Disconnect the 10X probe from TP162 and the Type 1A5.

m. Test equipment remains connected.

13. Check/Adjust U and V Quad Phase and Carrier Balance

a. Set the Type 1A5 A Input AC-GND-DC switch to DC and the Volts/Cm switch to .2 V.

b. From the Type 142 TEST SIGNAL connector, connect a 75 ohm coaxial cable and a 75 ohm termination to the Type 1A5 A Input connector.

c. Observing the test oscilloscope display, rotate the Type 1A5 Position control to position the blanking level of the display to the center graticule line. Set the Type 142 COLOR BAR U, V, and Y switches down; set the SYNCHRONIZATION TEST SIGNAL switch to NON COMP.

d. Set the Type 1A5 Volts/Cm switch to 2 mV. Use the Type 1A5 Comparison Voltage Amplitude control with —Polarity to position the blanking level to the center graticule line.

e. CHECK—Test oscilloscope display; amplitude of chrominance on the blanking level must be 2.5 mV peak to peak or less. (Disregard the switching transients.)

NOTE

Proceed to part k for Performance Check.

f. Replace the 75 ohm termination from the Type 1A5 A Input connector with the 011-0100-01 Voltage Step Up Termination. Set the Type 1A5 Polarity switch to 0.

g. ADJUST—C157, R148, C152, and R142, (see Fig. 5-14) for minimum peak-to-peak chrominance on the blanking level.

h. Set the Type 1A5 Volts/Cm switch to 1 mV and repeat part g.

NOTE

C157, R148, C152, and R142 adjustments interact. Repeat the adjustments several times to obtain an absolute minimum.

i. Replace the 011-0100-01 Voltage Step Up Termination with the 75 ohm termination.

j. Repeat parts d and e.

k. Set the Type 1A5 A Input AC-GND-DC switch to GND and the Polarity switch to 0.

l. Test equipment remains connected.

14. Check/Adjust Phase Switcher

a. Connect a 75 ohm end-line termination to the Type 522 PAL Vectorscope CH A J2 connector.

b. From the Type 142 rear-panel TEST SIGNAL connector, connect a 75 ohm coaxial cable to the vectorscope CH A J1 connector.

c. Set the Type 142 SYNCHRONIZATION TEST SIGNAL switch to COMP.

d. Observing the vectorscope display, rotate the Channel A Phase control to align the burst vectors at 135° and 225° as shown in Fig. 5-16A.

e. Set the Type 142 COLOR BAR U switch up.

f. CHECK—Vectorscope display; U axis dots must overlay each other within 0.5°; see Fig. 5-16B. Use the vectorscope Calibrated Phase dial to measure any error.

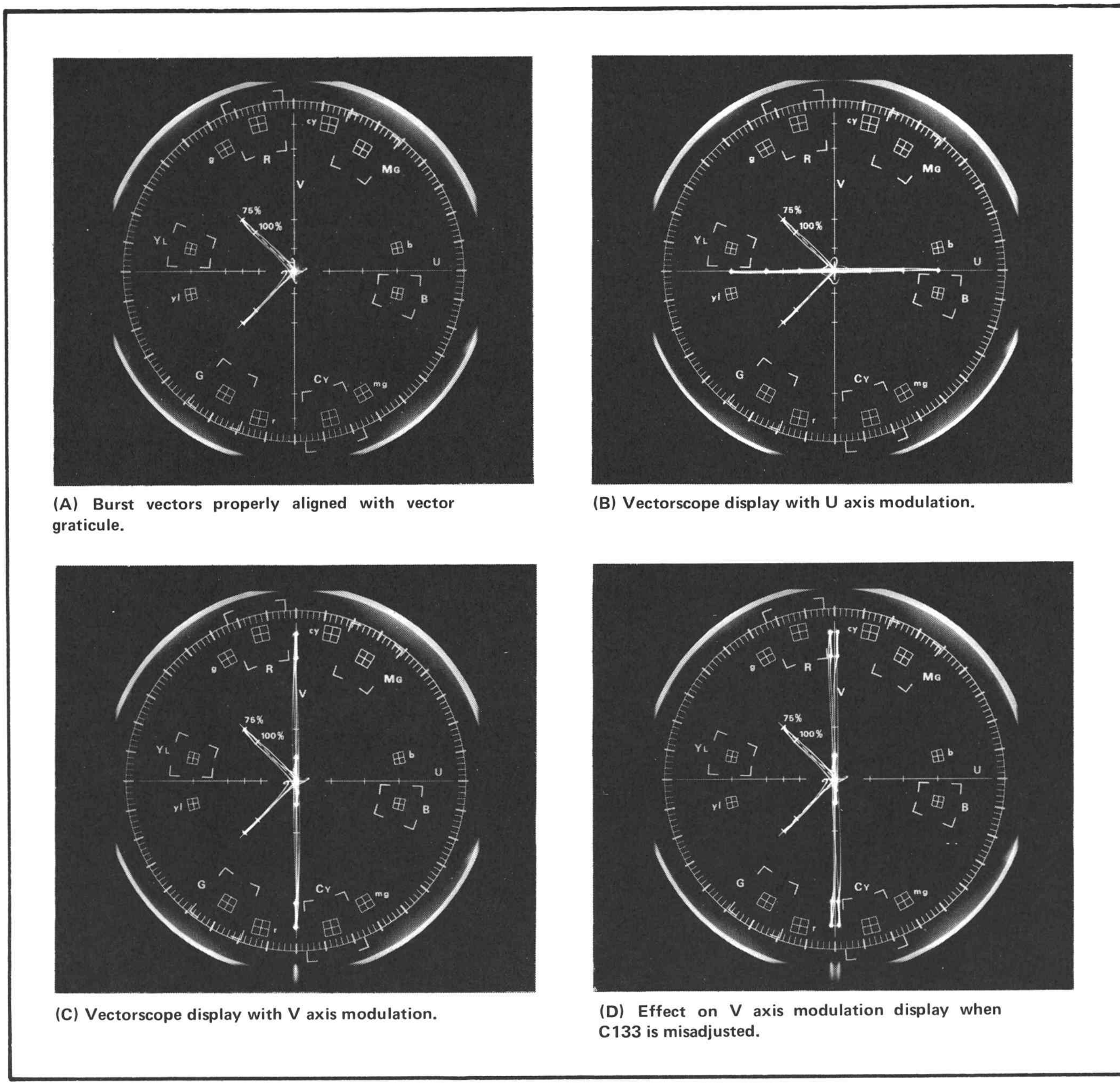
g. Set the Type 142 COLOR BAR U switch down and the V switch up.

h. CHECK—Vectorscope display; V axis dots must overlay each other within 0.5°; see Fig. 5-16C. Use the vectorscope Calibrated Phase dial to measure any error.

i. ADJUST—C133 (see Fig. 5-14) until the requirement in part h is met. Adjustment of C133 has the most effect on the V axis display. Fig. 5-16D shows an improper display.

j. Set the Type 142 COLOR BAR U switch up.

k. Test equipment remains connected.



(A) Burst vectors properly aligned with vector graticule.

(B) Vectorscope display with U axis modulation.

(C) Vectorscope display with V axis modulation.

(D) Effect on V axis modulation display when C133 is misadjusted.

Fig. 5-16. Typical vectorscope displays obtained when checking or adjusting the Phase Switcher.

15. Check/Adjust Modulator Phasing

a. Replace the 75 ohm termination on the Type 1A5 A Input connector with the 011-0100-01 Voltage Step Up Termination. Then, set the Volts/Cm switch to 10 mV, A Input AC-GND-DC switch to DC, Position control to midrange, Comparison Voltage Polarity switch +, and rotate the Comparison Voltage Amplitude control to position the positive peaks of the display as shown in Fig. 5-17A.

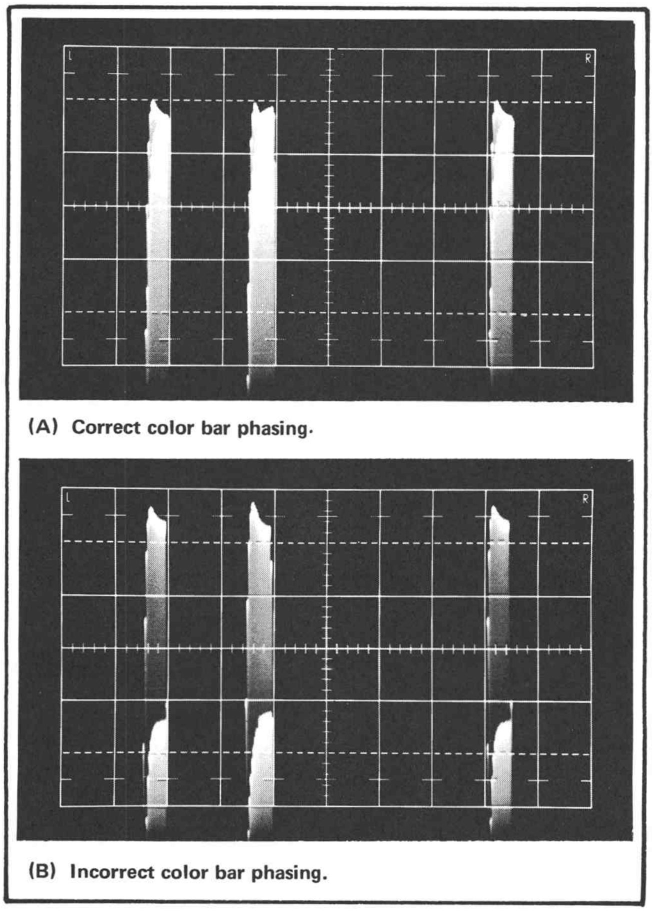
b. CHECK—Test oscilloscope display; displays must overlay within 10 mV. (Typically 8 mV.)

c. Set the Type 1A5 Comparison Voltage Amplitude control to −.

d. Repeat part b using the negative peaks of the display.

e. ADJUST—L126 (see Fig. 5-14) for best color bar overlay; must be within 10 mV. (See Fig. 5-17B for improper display.)

f. Set the Type 1A5 Comparison Voltage Amplitude Polarity switch to +.



(A) Correct color bar phasing.

(B) Incorrect color bar phasing.

Fig. 5-17. Typical displays showing correct and incorrect adjustment of color bar phasing. (Using Voltage Step-Up Termination.)

g. Repeat part e.

h. INTERACTION—If step 15 is performed out of sequence, step 13 must also be repeated before continuing.

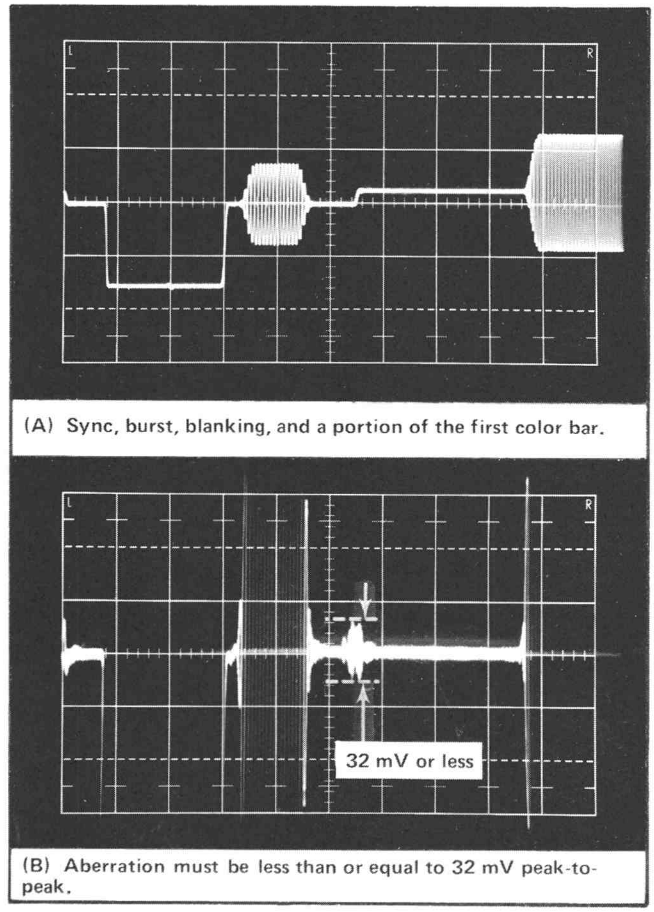
i. Test equipment remains connected.

16. Adjust Spurious Subcarrier

a. Set the Type 1A5 Volts/Cm switch to .2 V and the Comparison Voltage Polarity switch to 0. Then, replace the 011-0100-01 Voltage Step Up Termination with a 75 ohm termination.

b. Set the test oscilloscope Time Base A Time/Cm switch to 2 µs and rotate the Horizontal Position control to position the display horizontally on the test oscilloscope as shown in Fig. 5-18A.

c. Remove Q436; see Fig. 5-19.



(A) Sync, burst, blanking, and a portion of the first color bar.

(B) Aberration must be less than or equal to 32 mV peak-to-peak.

Fig. 5-18. Typical displays used to check and/or adjust spurious subcarrier.

d. Set the Type 1A5 Volts/Cm switch to 10 mV.

e. CHECK—Test oscilloscope display; 3.57 MHz aberration between burst and the first color bar must be less than or equal to 32 mV peak to peak; see Fig. 5-18B.

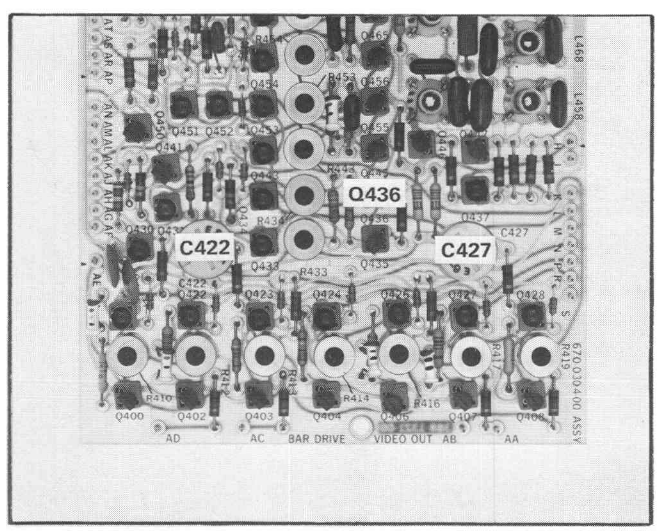


Fig. 5-19. Transistor and adjustment locations on the Bar Drive and Video Out board.

f. Set the Type 142 COLOR BAR U switch down.

g. ADJUST—C422, see Fig. 5-19, and readjust L163, see Fig. 5-14, for minimum 3.57 MHz aberration between burst and the first color bar.

h. Set the Type 142 COLOR BAR V switch down and the U switch up.

i. ADJUST—C427, see Fig. 5-19, and readjust L167, see Fig. 5-14, for minimum 3.57 MHz aberration between burst and the first color bar.

j. Set the Type 142 COLOR BAR V switch up.

k. Repeat part e.

l. Re-install Q436.

m. Test equipment remains connected.

17. Check Spurious Output

a. Set the Type 1A5 Volts/Cm switch to .2 V.

b. Set the test oscilloscope Horizontal Display Sweep Magnifier switch to X2.

c. Observing the test oscilloscope display, rotate the Horizontal Position control to center the line blanking pulse on the graticule.

d. Set the Type 1A5 Volts/Cm switch to 10 mV and the Comparison Voltage Polarity switch to —.

e. Observing the test oscilloscope display, rotate the Type 1A5 Comparison Voltage Amplitude control to position the line blanking pulse to the center of the graticule.

f. CHECK—Test oscilloscope display; spurious output at center of line blanking pulse must be less than or equal to 32 mV peak to peak.

g. Test equipment remains connected.

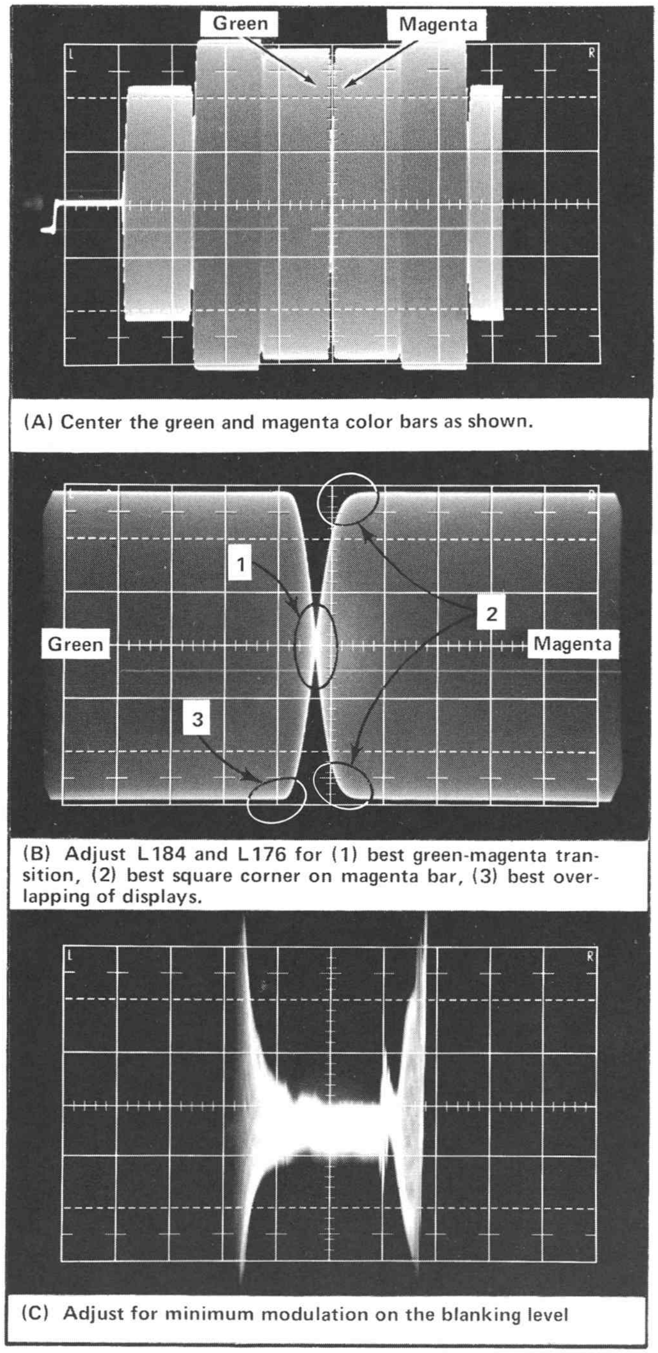
18. Adjust Modulator Output Filter

a. Set the Type 1A5 Volts/Cm switch to .1 V and the Comparison Voltage Polarity switch to 0.

b. Set the test oscilloscope Time Base A Time/Cm switch to 5 μs and the Horizontal Display Sweep Magnifier switch to X10.

c. Observing the test oscilloscope display, rotate the Horizontal Position controls to position the green-magenta transition to the center (horizontal) graticule lines as shown in Fig. 5-20A.

d. Remove Q683; see Fig. 5-5.



(A) Center the green and magenta color bars as shown.

(B) Adjust L184 and L176 for (1) best green-magenta transition, (2) best square corner on magenta bar, (3) best overlapping of displays.

(C) Adjust for minimum modulation on the blanking level

Fig. 5-20. Typical displays to adjust the Modulator Output Filter.

e. ADJUST—L176 and L184, see Fig. 5-14, for (1) best green-magenta transition; (2) best square corner on the magenta chrominance; (3) best overlay of the displays. See Fig. 5-20B.

f. Set the test oscilloscope Sweep Magnifier switch to Off. Position the blanking level portion of the display, located between burst and the setup level, to the center of the graticule.

g. Set the test oscilloscope Sweep Magnifier switch to X10 and the Type 1A5 Volts/Cm switch to 2 mV.

h. CHECK—Test oscilloscope display; peak to peak chrominance amplitude on the blanking level should be 2.5 mV or less (see Fig. 5-20C).

i. READJUST—L176 and L184 for less than 2.5 mV peak to peak of chrominance on the blanking level.

j. Set the Type 1A5 Volts/Cm switch to .1 V and the test oscilloscope Sweep Magnifier switch to Off.

k. Repeat parts c through k several times, due to interaction between the adjustments.

l. Re-install Q683, removed in part e.

m. INTERACTION—Step 19 must be completed.

n. Disconnect all test equipment and connections.

NOTES

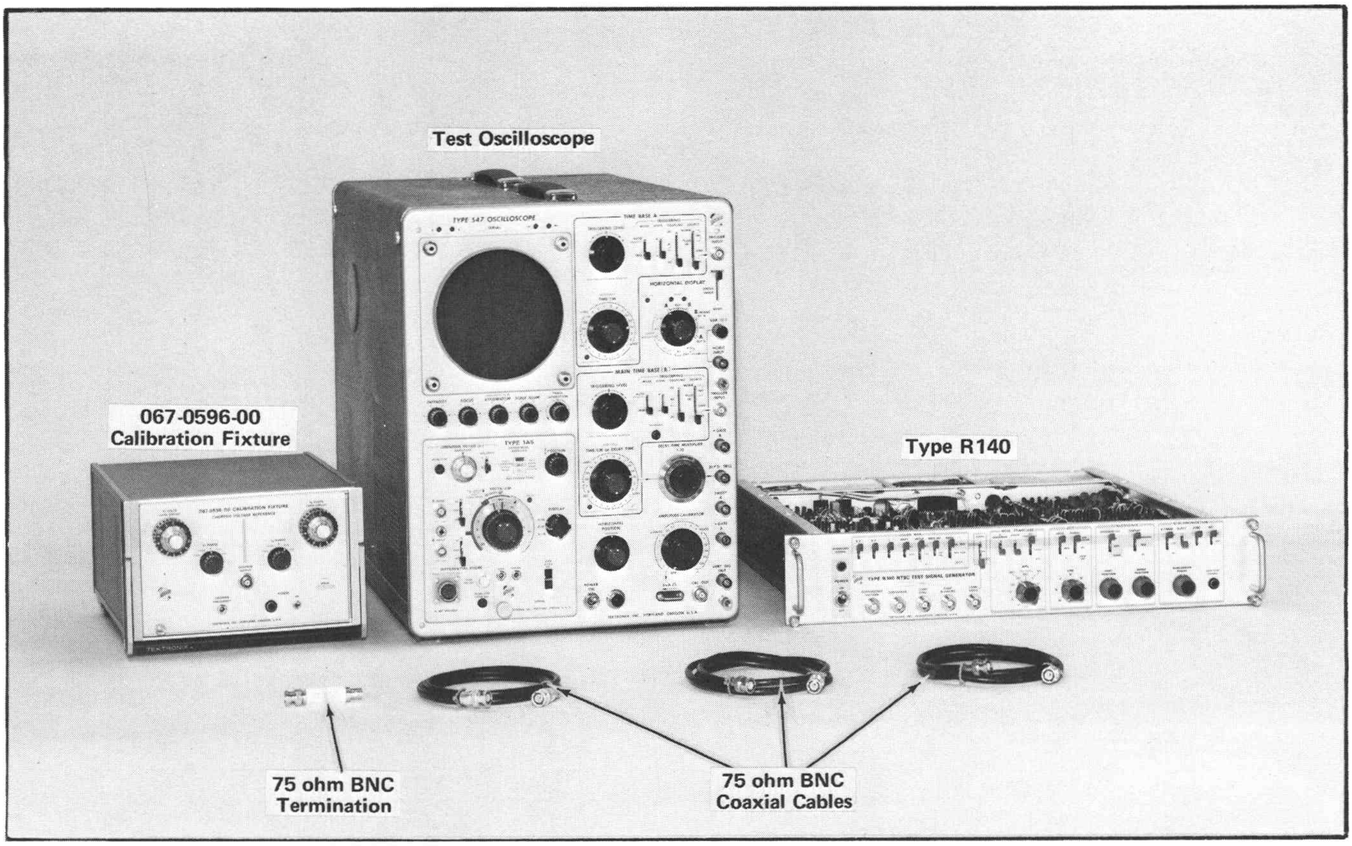


Fig. 5-21. Test equipment required for steps 19 through 40.

Type 142 Controls

Y	Down
FULL FIELD	Down
MOD STAIRCASE	
U SUBCARRIER	Down
STEPS	Down
V SUBCARRIER	MOD

Test Oscilloscope Controls

Viewing	As desired
Time Base A	
Triggering Level	CW, pushed in
Triggering	
Mode	Auto
Slope	+
Coupling	AC
Source	Norm
Time/Cm	1 µs
Time Base B	
Triggering Level	Near 0, pushed in
Triggering	
Mode	Trig
Slope	—
Coupling	DC
Source	Ext
Time/Cm	10 µs
Variable (Time/Cm)	Calibrated
Horizontal Display	B
Vertical Amplifier (Type 1A5)	
A Input AC-GND-DC	DC
B Input AC-GND-DC	DC
Volts/Cm	.2 V
Display	A-B

067-0596-00 Calibration Fixture Controls

V_1	
Range	−1.1 V
Volts	3-0-10
V_2	
Range	+1.1 V
Volts	3-0-10

19. Check/Adjust Chrominance Amplifier

a. Test equipment is shown in Fig. 5-21. To determine the Type 142 and test oscilloscope control settings, first refer to the partial list that precedes this step and then, for the remaining controls, refer to the list that follows Fig. 5-1.

b. From the Type 142 TEST SIGNAL connector, connect a 75 ohm coaxial cable and a 75 ohm termination to the Type 1A5 A Input Connector.

c. From the Type 142 rear-panel COMP BLANKING connector, connect a 75 ohm coaxial cable to the test oscilloscope Time Base B Trigger Input connector.

d. From the 067-0596-00 calibration fixture Chopped Output connector, connect a 75 ohm coaxial cable to the Type 1A5 B Input connector.

e. Set the test oscilloscope Time Base B Trigger Level control for a triggered display.

f. Observing the test oscilloscope displays, rotate the 067-0596-00 calibration fixture V_2 Volts control until the top of the bottom display just meets the bottom of the top display.

g. Set the Type 1A5 Volts/Cm switch to 10 mV.

h. Repeat part f.

i. CHECK—067-0596-00 calibration fixture V_2 Volts control dial setting; must be between 2-8-30 and 3-1-93 (600 mV, ±3%).

j. Set the 067-0596-00 Calibration fixture V_2 Volts control for a dial setting of 3-0-10.

k. ADJUST—R482 (see Fig. 5-22) until the top of the bottom display just meets with the bottom of the top display.

l. Test equipment remains connected.

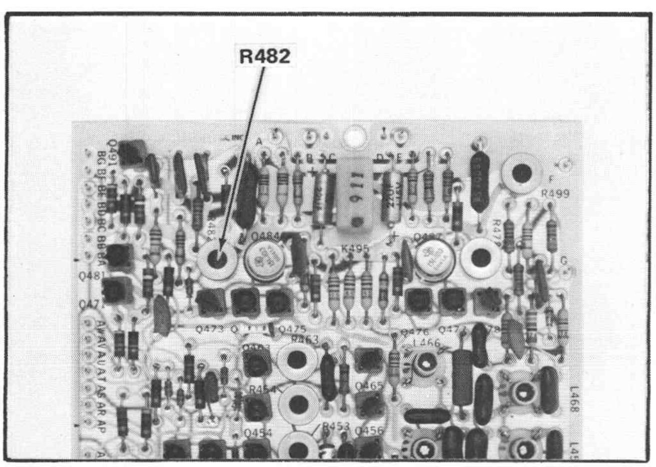


Fig. 5-22. Bar Drive and Video Out board adjustment location.

20. Check APL Subcarrier Modulation Amplitude and Duration

NOTE

If any of the following checks are not within the listed tolerance, repeat step 19.

a. Set the Type 1A5 Volts/Cm switch to .2 V.

b. Set the Type 142 MOD STAIRCASE V SUBCARRIER switch to OFF.

c. CHECK—Test oscilloscope display; modulation should not be present on the display.

d. Set the Type 142 MOD STAIRCASE V SUBCARRIER switch to UNMOD.

e. Set the 067-0596-00 calibration fixture V_1 Range switch to 0 and the V_2 Volts control for a dial setting of 0-3-01 (30 mV).

f. Set the Type 1A5 Volts/Cm switch to 10 mV.

g. Observing the test oscilloscope display, rotate the 067-0596-00 calibration fixture V_2 Volts control until the two displays just meet.

h. CHECK—067-0596-00 calibration fixture V_2 Volts control dial setting; dial setting must be between 0-2-36 and 0-3-16 (30 mV, ±1.5 mV).

i. Set the Type 1A5 B Input AC-GND-DC switch to GND.

j. CHECK—Test oscilloscope display; duration of modulation should be approximately 52.3 μs (as measured from the 50% points between the blanking level and the most positive excursion of the modulation).

k. Set the Type 1A5 Volts/Cm switch to .2 V.

l. Set the Type 142 MOD STAIRCASE V SUBCARRIER switch to MOD.

m. CHECK—Test oscilloscope display; display should be similar to Fig. 5-23.

n. Set the 067-0596-00 calibration fixture V_1 Range switch to −1.1 V and the V_1 and V_2 Volts controls for dial settings of 0-1-50 each (30 mV).

o. Set the Type 1A5 Volts/Cm switch to 10 mV and the B input AC-GND-DC switch to DC.

p. Observing the test oscilloscope display of the first or fourth modulation envelope, rotate the 067-0596-00 V_2 Volts control until the two displays just meet.

q. CHECK—067-0596-00 calibration fixture V_2 Volts control dial setting; dial setting must be between 0-1-35 and 0-1-65 (30 mV, ±1.5 mV).

r. Set the 067-0596-00 calibration fixture V_1 and V_2 Volts controls for dial settings of 1-5-05 each (300 mV).

s. Repeat part p using the second or fourth modulation envelope.

t. CHECK—067-0596-00 calibration fixture V_2 Volts control dial settings; dial setting must be between 1-4-14 and 1-5-95 (300 mV, ±3%).

u. Set the 067-0596-00 V_1 and V_2 Volts controls for dial settings of 3-0-10 each (600 mV).

v. Repeat part p using the third modulation envelope.

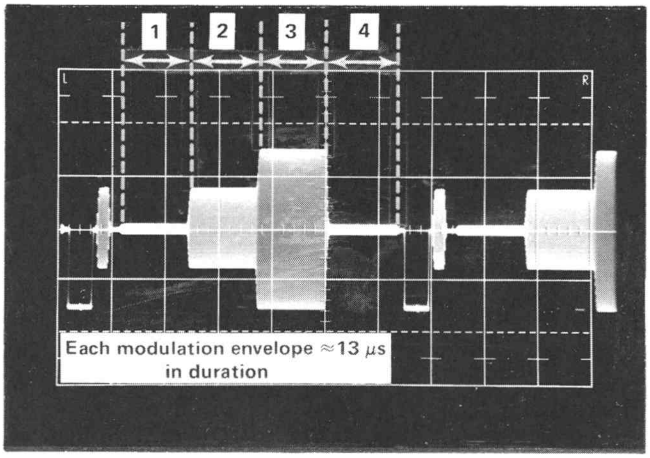


Fig. 5-23. Typical display showing the modulated subcarrier. Used to check amplitude and duration.

w. CHECK—067-0596-00 calibration fixture V_2 Volts control dial setting; dial setting must be between 2-8-30 and 3-1-93 (600 mV, ±3%).

x. Set the Type 1A5 Volts/Cm switch to .2 V, Display switch to A-Vc and the B Input AC-GND-DC switch to GND.

y. Set the test oscilloscope Sweep Magnifier switch to X5.

z. CHECK—Test oscilloscope display; duration of each modulation envelope should be approximately 13.2 μs (as measured from the 50% points of each envelope).

aa. Test equipment remains connected.

21. Check Chrominance Amplitudes

a. Set the Type 142 COLOR BAR Y switch up and the FULL FIELD switch up.

b. Set the test oscilloscope Horizontal Display switch to B Intens By 'A' and the Sweep Magnifier switch to Off.

c. Set the test oscilloscope Delay-Time Multiplier control so that white is intensified as shown in Fig. 5-24A.

d. Set the test oscilloscope Horizontal Display switch to A Dly'd.

e. Set the Type 1A5 Volts/Cm switch to 1 mV, Comparison Voltage Polarity switch to +, and rotate the Comparison Voltage Amplitude control to position the intensified white portion of the display on the test oscilloscope graticule.

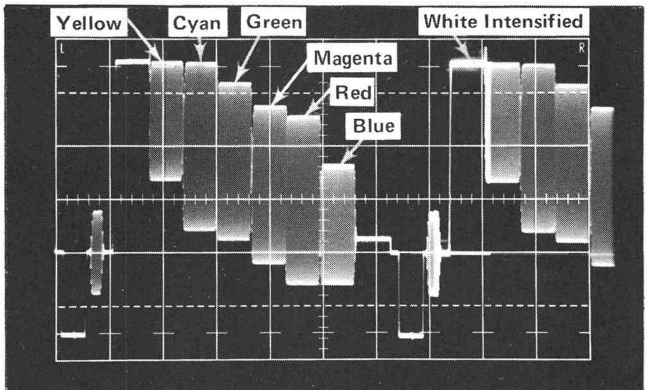
f. CHECK—Test oscilloscope display; peak-to-peak chrominance on white must be 2.5 mV peak to peak or less (see Fig. 5-24B). Tilt of white level display is normal.

NOTE

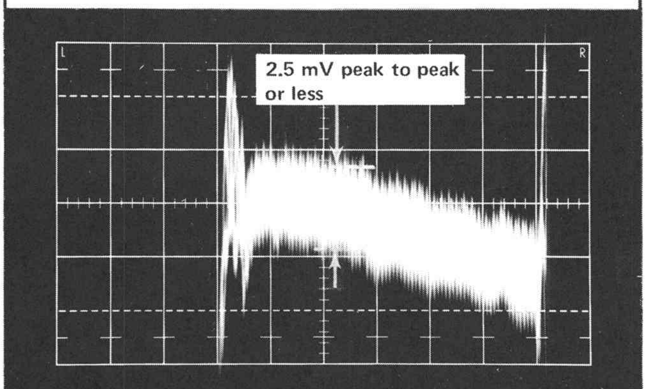
If part f is not within the listed tolerance, or if any of the following checks are not within the stated tolerance, proceed to Step 22 before continuing with step 21.

g. Set the test oscilloscope Horizontal Display switch to B Intens By 'A', and the Time Base A Time/Cm switch to .5 μs.

Ⓐ



(A) Color bar signal with white intensified.



(B) Modulation on white must be less than or equal to 2.5 mV peak to peak.

Fig. 5-24. Typical displays showing location of color signal components and white modulation.

h. Set the Type 142 COLOR BAR Y switch down.

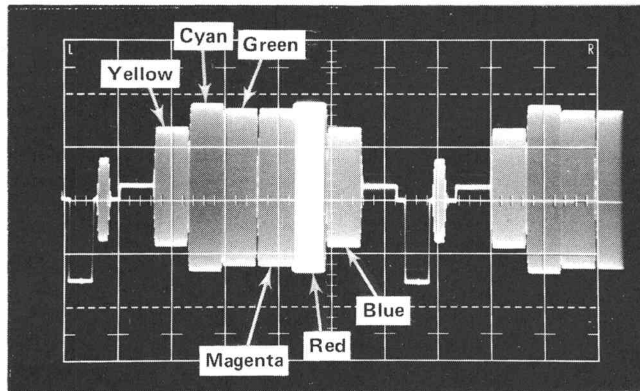
i. Set the Type 1A5 Volts/Cm switch to .2 V, Comparison Voltage Polarity switch to 0, and rotate the Position control to center the display on the test oscilloscope.

j. Observing the test oscilloscope display, rotate the Delay-Time Multiplier control until the red color bar is intensified; see Fig. 5-25A.

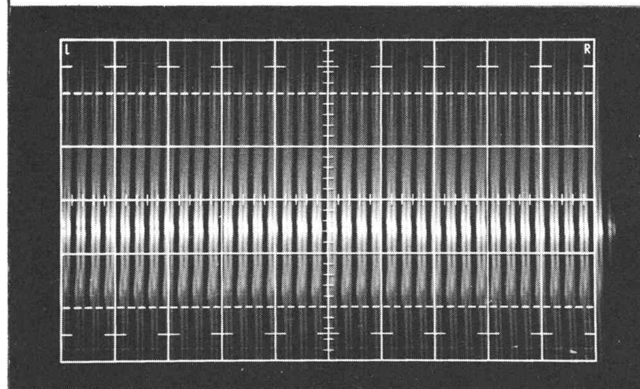
k. Set the 067-0596-00 calibration fixture V_1 and V_2 Volts controls for a dial setting of 3-0-93 each (616.4 mV).

l. Set the test oscilloscope Horizontal Display switch to A Dly'd.

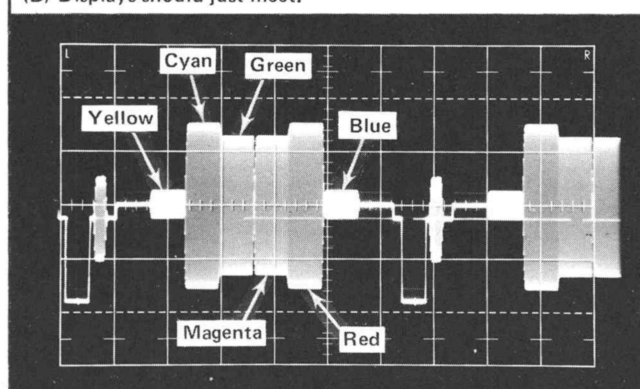
m. Set the Type 1A5 Volts/Cm switch to 10 mV, Display switch to A-B, B Input AC-GND-DC switch to DC and rotate the Position control to position the display on the test oscilloscope as shown in Fig. 5-25B.



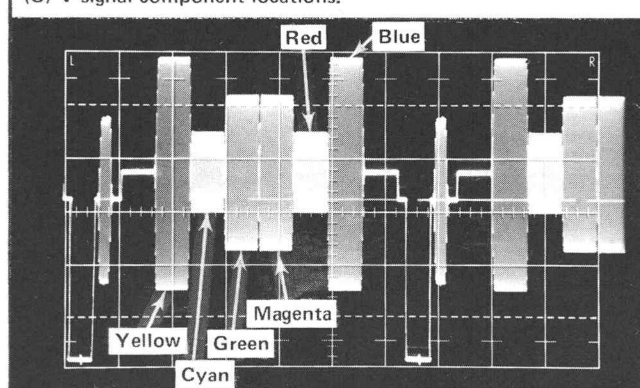
(A) Chrominance signal with red intensified.



(B) Displays should just meet.



(C) V signal component locations.



(D) U signal component locations.

Fig. 5-25. Typical displays of the chrominance U and V signals.

n. Observing the test oscilloscope display, rotate the 067-0596-00 calibration fixture V_2 Volts control until the top of the bottom display just meets the bottom of the top display (see Fig. 5-24B).

o. CHECK—067-0596-00 calibration fixture V_2 Volts control dial setting; dial setting must be between 2-9-07 and 3-2-81 (616.4 mV, ±3%).

p. Using the 067-0596-00 calibration fixture V_2 Volts control dial setting obtained in part o, compute and record the percentage error, if any, above or below the standard dial setting for the red color bar.

NOTE

The percentage error computed in this part will be used to determine the error, if any, of the remaining chrominance amplitudes. For example, assume the V_2 Volts control dial setting obtained in part o was 2-9-07 (3% low) or 3-2-81 (3% high).

Add: V_1 and V_2 dial setting obtained in part o.

$$309.3 + 290.7 = 600 \text{ or}$$
$$309.3 + 328.1 = 637.4.$$

Add: V_1 and V_2 Volts control dial settings for the standard value of the red color bar

$$309.3 + 309.3 = 618.6.$$

Subtract: Total dial settings obtained in part o from the total dial readings for the red color bar

$$618.6 - 600 = 18.6 \text{ low or}$$
$$618.6 - 637.4 = 18.6 \text{ high.}$$

% or error:

$$\frac{(18.6)\,(100)}{618.6} \cong 3\% \text{ low or high.}$$

q. Set the test oscilloscope Horizontal Display switch to B Intens By 'A'.

r. Set the Type 1A5 B Input AC-GND-DC switch to GND, Volts/Cm switch to .2 V and rotate the Position control to center the display on the test oscilloscope.

s. Observing the test oscilloscope display, rotate the Delay-Time Multiplier control until the blue color bar is intensified.

t. Set the 067-0596-00 calibration fixture V_1 and V_2 Volts controls for a dial setting of 2-1-92 each (436.9 mV).

u. Repeat parts l, m, and n.

v. CHECK—067-0596-00 calibration fixture V_2 Volts control dial setting; dial setting for the blue color bar must be within 1% of the error recorded for the red color bar in part p, but in no case must the total error for the blue color bar be greater than 3% above or below the standard dial setting.

NOTE

Referring back to the example given following part p, the percentage error was found to be either 3% low or 3% high. With this error, the dial reading obtained in part v would have to be between 2% and 3% below, or between 2% and 3% above, the standard value of the blue color bar. In other words, the V_2 Volts control dial setting must be between 2-0-93 and 2-0-49 (2% to 3% below), or between 2-2-90 and 2-3-34 (2% to 3% above).

w. Using the procedure just described for checking the amplitude of the blue color bar, (Fig. 5-25A, B, C, and D) check each remaining chrominance amplitude listed in Table 5-2.

x. Set the Type 142 COLOR BAR U and V switches up, and the AMPL switch to 100%.

y. Repeat parts h through v for all components listed in Table 5-3.

NOTE

All values are different than those shown in Table 5-2, but procedure is identical.

z. Test equipment remains connected.

22. Adjust Chrominance Amplitudes ❶

a. Set the controls as follows:

Type 142 Controls

COLOR BAR	
U	Down
V	Up
AMPL	75%
MOD STAIRCASE	All up

TABLE 5-2

Color (See Tolerance)	067-0596-00 Calibration Fixture			Tolerance
	V_1 Volts	V_2 Volts	Amplitude P-P	
Magenta	2-8-89	2-8-89	575.8 mV	Absolute amplitude of all Subcarrier frequency components (Chrominance, U and V) are within 3%.
Green	2-8-89	2-8-89	575.8 mV	
Cyan	3-0-93	3-0-93	616.4 mV	
Yellow	2-1-92	2-1-92	436.9 mV	
Blue[3]	0-4-89	0-4-89	97.5 mV	
Red[3]	3-0-07	3-0-07	599.4 mV	
Magenta[3]	2-5-19	2-5-19	501.9 mV	Relative amplitudes of all Subcarrier frequency components are within 1% of the red chrominance bar.
Green[3]	2-5-19	2-5-19	501.9 mV	
Cyan[3]	3-0-07	3-0-07	599.4 mV	
Yellow[3]	0-4-89	0-4-89	97.5 mV	
Blue[4]	2-1-36	2-1-36	425.9 mV	
Red[4]	0-7-20	0-7-20	143.7 mV	
Magenta[4]	1-4-16	1-4-16	282.2 mV	
Green[4]	1-4-16	1-4-16	282.2 mV	
Cyan[4]	0-7-20	0-7-20	143.7 mV	
Yellow[4]	2-1-36	2-1-36	425.9 mV	

[3]Set the Type 142 COLOR BAR U switch down.

[4]Set the Type 142 COLOR BAR U switch up and the V switch down; set the Type 1A5 Volts/Cm switch to .1 V instead of .2 V.

TABLE 5-3

Color (See Tolerance)	067-0596-00 Calibration Fixture			Tolerance
	V_1 Volts	V_2 Volts	Amplitude P-P	
Red	4-1-26	4-1-26	821.9 mV	Absolute amplitudes of all Subcarrier frequency components (Chrominance, U and V) are within 3%.
Blue	2-9-23	2-9-23	582.5 mV	
Magenta	3-8-54	3-8-54	767.7 mV	
Green	3-8-54	3-8-54	767.7 mV	
Cyan	4-1-26	4-1-26	821.9 mV	
Yellow	2-9-23	2-9-23	582.5 mV	Relative amplitudes of all Subcarrier frequency components are within 1% of the red chrominance bar.
Blue[5]	0-6-52	0-6-52	130 mV	
Red[5]	4-0-11	4-0-11	799.2 mV	
Magenta[5]	3-3-61	2-3-61	669.2 mV	
Green[5]	3-3-61	2-3-61	669.2 mV	
Cyan[5]	4-0-11	4-0-11	799.2 mV	
Yellow[5]	0-6-52	0-6-52	130 mV	
Blue[6]	2-8-49	2-3-49	567.8 mV	
Red[6]	0-9-60	0-9-60	191.6 mV	
Magenta[6]	1-8-87	1-8-87	376.2 mV	
Green[6]	1-8-87	1-8-87	376.2 mV	
Cyan[6]	0-9-60	0-9-60	191.6 mV	
Yellow[6]	2-8-49	2-8-49	567.8 mV	

[5]Set the Type 142 COLOR BAR U switch down.

[6]Set the Type 142 COLOR BAR U switch up and the V switch down; set the Type 1A5 Volts/Cm switch to .1 V instead of .2 V.

Test Oscilloscope Controls

Time/Cm (Time Base A)	.5 µs
Horizontal Display	B Intens By 'A'
Volts/Cm	.2 V

067-0596-00 Calibration Fixture Controls

V_1 and V_2 Volts	0-4-89

b. Remove Q436 (see Fig. 5-26). Check that the COLOR BAR Y switch is down.

c. Observing the test oscilloscope display, rotate the Delay-Time Multiplier control to intensify the blue color bar. Then, set the Horizontal Display switch to A Dly'd and the Type 1A5 Volts/Cm switch to 10 mV.

d. ADJUST—R410 (see Fig. 5-26) until the two displays just meet.

e. Set the Type 1A5 Volts/Cm switch to .2 V and the test oscilloscope Horizontal Display switch to B Intens by 'A'.

f. Set the 067-0596-00 calibration fixture V_1 and V_2 Volts controls for a dial setting of 2-5-19 each (501.9 mV).

g. Repeat part c using the green color bar.

h. ADJUST—R412 (see Fig. 5-26) until the two displays just meet.

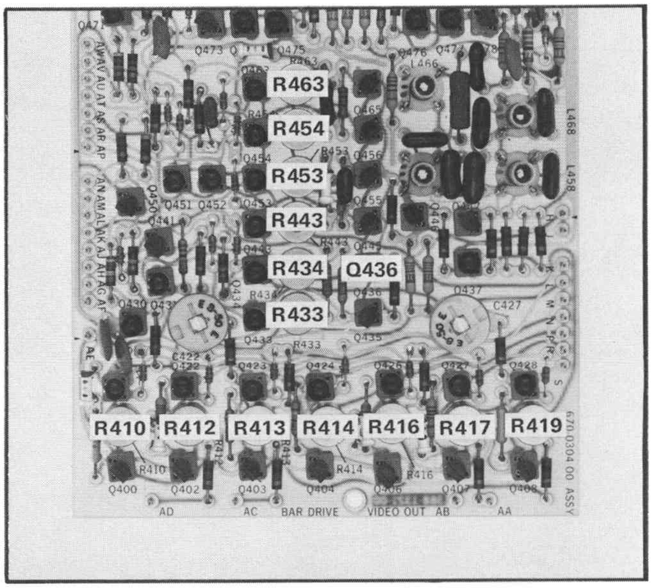


Fig. 5-26. Transistor and adjustment locations on the Bar Drive and Video Out board.

i. Repeat part e.

j. Rotate the test oscilloscope Delay-Time Multiplier control to intensify the blanking level just prior to the yellow color bar.

k. Set the Type 1A5 Display switch to A-Vc, Volts/Cm switch to 2 mV, and the test oscilloscope Horizontal Display switch to A Dly'd.

l. ADJUST—R413 (see Fig. 5-26) for minimum modulation on the blanking level.

m. Repeat part e.

n. Set the Type 142 COLOR BAR U switch up and the V switch down.

o. Set the Type 1A5 Display switch to A-B.

p. Set the 067-0596-00 calibration fixture V_1 and V_2 Volts controls for dial settings of 0-7-20 each (143.7 mV).

q. Repeat part c using the red color bar.

r. ADJUST—R416 (see Fig. 5-26) until the two displays just meet.

s. Repeat part e.

t. Set the 067-0596-00 calibration fixture V_1 and V_2 Volts controls for dial settings of 1-4-16 each (282.2 mV).

u. Repeat part c using the green color bar.

v. ADJUST—R417 (see Fig. 5-26) until the two displays just meet.

w. Repeat (in listed order) parts e, j, and k.

x. ADJUST—R419 (see Fig. 5-26) for minimum modulation on the blanking level.

y. Replace Q436 (removed in part b).

z. Set the Type 142 COLOR BAR V switch up.

aa. Repeat steps 19 through 21 before continuing to step 23.

ab. Test equipment remains connected.

23. Check/Adjust Burst Amplitude

a. Set the controls as follows:

Type 142 Controls

COLOR BAR	
V	Up
AMPL	75%
MOD STAIRCASE	All up

Test Oscilloscope Controls

Time/Cm (Time Base A)	.5 µs
Horizontal Display	B Intens By 'A'
Volts/Cm	.2 V

067-0596-00 Calibration Fixture Controls

V_1 and V_2 Volts	1-5-05

b. Check that the Type 142 COLOR BAR U switch is up and the Y switch is down. Rotate the test oscilloscope Delay-Time Multiplier control to intensify burst.

c. Set the Type 1A5 Volts/Cm switch to 10 mV and set the test oscilloscope Horizontal Display switch to A Dly'd.

d. Observing the test oscilloscope display, rotate the 067-0596-00 calibration fixture V_2 Volts control until the upper and lower burst displays just meet.

e. CHECK—067-0596-00 calibration fixture V_2 Volts control dial setting; dial setting must be between 1-4-14 and 1-5-95 (300 mV, ±3%).

f. Set the Type 142 BURST U switch down. Check that the BURST V switch is up.

g. Set the 067-0596-00 calibration fixture V_1 and V_2 Volts controls for a dial setting of 1-0-62 each (212 mV).

h. Observing the test oscilloscope display, rotate the 067-0596-00 calibration fixture V_2 Volts control until the top of the bottom burst display just meets the bottom of the top burst display.

i. CHECK—067-0596-00 calibration fixture V_2 Volts control dial setting; dial setting must be between 0-9-68 and 1-1-57 (212 mV, ±3%).

j. Set the 067-0596-00 calibration fixture V_2 Volts control for a dial setting of 1-0-62.

k. ADJUST—V Burst Level control, R232, (see Fig. 5-27) until the top of the bottom display just meets the bottom of the top display.

l. Set the Type 142 BURST U switch up and the V switch down.

m. Repeat parts h, i, and j.

n. ADJUST—U Burst Level control, R414, (see Fig. 5-26) until the top of the bottom burst display just meets the bottom of the top burst display.

o. Set the Type 142 BURST V switch up.

p. Rotate the 067-0596-00 calibration fixture V_1 and V_2 Volts controls for dial settings of 1-5-05 each (300 mV).

q. Repeat parts d and e.

r. Set the Type 1A5 Volts/Cm switch to 50 mV and the B Input AC-GND-DC switch to GND.

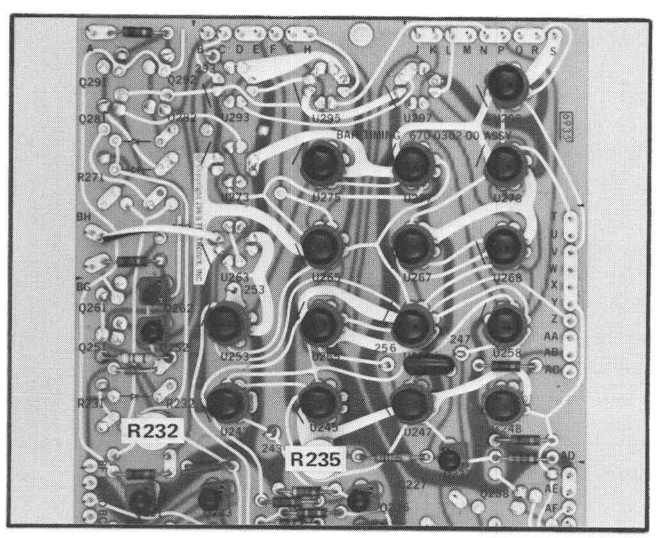


Fig. 5-27. Bar Timing board adjustment locations.

s. Set the Type 142 COLOR BAR U and V switches down.

t. Set the test oscilloscope Horizontal Display switch to B Intens By 'A', and the Time Base B Time/Cm switch to 50 μs.

u. Rotate the Type 1A5 Variable (Volts/Cm) control for an amplitude of 5 cm, as measured on the test oscilloscope, between the positive and negative peaks of the highest amplitude burst packet in the display.

v. CHECK—Test oscilloscope display; amplitude of burst packets to the left and right of the 5 cm burst amplitude must be between 97% and 100% of 5 cm.

w. Test equipment remains connected.

24. Check/Adjust Setup (Black) Level

a. Set the Type 1A5 Volts/Cm switch to .2 V, the Variable (Volts/Cm) control to Cal, and the B Input AC-GND-DC switch to DC.

b. Set the Type 142 COLOR BAR Y switch up.

c. Set the 067-0596-00 calibration fixture V_1 and V_2 Volts controls for dial settings of 0-2-50 each (50 mV).

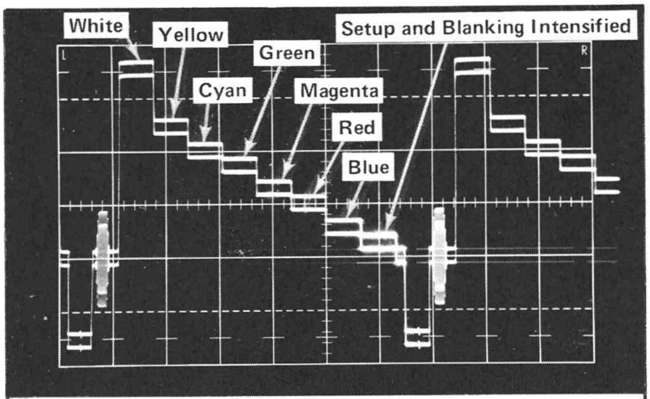
d. Set the test oscilloscope Time Base A Time/Cm switch to 1 μs and Time Base B Time/Cm switch to 10 μs. Then, observing the test oscilloscope display, rotate the Delay-Time Multiplier control until setup and blanking are intensified (see Fig. 5-28A).

e. Set the test oscilloscope Horizontal Display switch to A Dly'd and the Type 1A5 Volts/Cm switch to 10 mV.

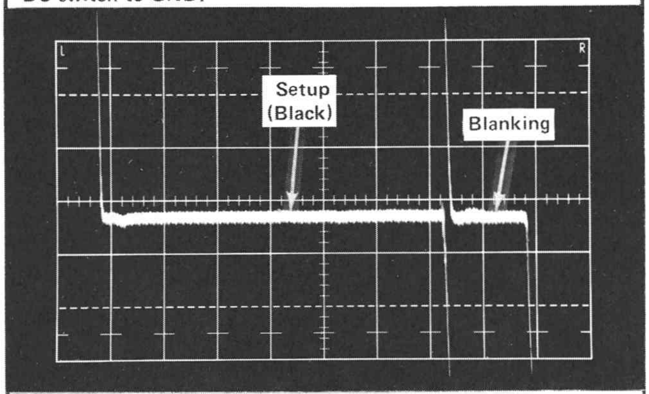
f. Observing the test oscilloscope display, rotate the 067-0596-00 calibration fixture V_2 Volts control until the setup level of the lower display just aligns with the blanking level of the upper display (see Fig. 5-28B).

g. CHECK—067-0596-00 calibration fixture V_2 Volts control dial setting; dial setting must be between 0-2-45 and 0-2-55 (50 mV, ±1%).

h. Set the 067-0596-00 calibration fixture V_2Volts control to a dial setting of 0-2-50.



(A) Luminance signal with setup and blanking intensified. To remove the dual displays, set the Type 1A5 B Input AC-GND-DC switch to GND.



(B) Setup level aligned with the blanking level.

Fig. 5-28. Typical displays used to check or adjust the setup level amplitude in step 24. Waveform (A) color bar luminance levels are identified for use in step 25 procedure.

i. ADJUST—R433 (see Fig. 5-26) until the setup level of the lower display just aligns with the blanking level of the upper display.

j. Test Equipment remains connected.

25. Check/Adjust Color Bar Luminance Levels

a. Set the Type 1A5 Volts/Cm switch to .2 V, the test oscilloscope Horizontal Display switch to B Intens By 'A' and the Time Base A Time/Cm switch to .1 μs.

b. Set the 067-0596-00 calibration fixture V_1 Range switch to 0 and the V_2 Volts control to 0-5-01 (50 mV).

c. Observing the test oscilloscope display, rotate the Delay-Time Multiplier control to intensify the blanking level.

d. Set the Type 1A5 Volts/Cm switch to 10 mV and use the (Vertical) Position control to position the intensified blanking level to graticule center for use as a reference.

NOTE

During the remaining portion of this procedure, use the Type 1A5 Position control (when necessary) to maintain the blanking level at graticule center.

e. Set the Type 1A5 Volts/Cm switch to 10 mV. Then, observing the test oscilloscope display, rotate the 067-0596-00 calibration fixture V_2 Volts control until the setup level is aligned with the blanking level (see Fig. 5-28B).

f. CHECK—067-0596-00 calibration fixture V_2 Volts control dial setting; dial setting must be between 0-4-96 and 0-5-06 (50 mV, ±1%).

g. Set the 067-0596-00 calibration fixture V_2 Volts control for a dial setting of approximately 1-0-58.

h. Observing the test oscilloscope display, rotate the 067-0596-00 calibration fixture V_2 Volts control until the blue level is aligned with the blanking level.

i. CHECK—067-0596-00 calibration fixture V_2 Volts control dial setting; dial setting must be between 1-0-48 and 1-0-69 (105.6 mV, ±1%).

j. Set the 067-0596-00 calibration fixture V_2 Volts control for a dial setting of 1-0-58.

k. ADJUST—R463 (see Fig. 5-26) until the blue luminance level aligns with the blanking level.

l. Observing the test oscilloscope display, rotate the 067-0596-00 calibration fixture V_2 Volts control until the red luminance level aligns with the blanking level.

m. CHECK—067-0596-00 calibration fixture V_2 Volts control dial setting; dial setting must be between 1-9-43 and 1-9-82 (195.7 mV, ±1%).

n. Set the 067-0596-00 calibration fixture V_2 Volts control for a dial setting of 1-9-62.

o. ADJUST—R453 (see Fig. 5-26) until the red luminance level aligns with the blanking level.

p. Repeat part l using the green luminance level.

q. CHECK—067-0596-00 calibration fixture V_2 Volts control dial setting; dial setting must be between 3-3-43 and 3-4-11 (336.2 mV, ±1%).

r. Set the 067-0596-00 calibration fixture V_2 Volts control for a dial setting of 3-3-77.

s. ADJUST—R454 (see Fig. 5-26) until the green luminance level aligns with the blanking level.

t. Repeat part l using the white level.

u. CHECK—067-0596-00 calibration fixture V_2 Volts control dial setting; dial setting must be between 6-9-58 and 7-1-00 (700 mV, ±1%).

NOTE

Tilt of white luminance level is normal.

v. Set the 067-0596-00 calibration fixture V_2 Volts control for a dial setting of 7-0-28.

w. ADJUST—R443 (see Fig. 5-26) until the white level aligns with the blanking level. (Use center of white bar.)

x. CHECK—Using the preceding procedure to check and/or adjust the luminance levels, check all remaining luminance levels listed in Table 5-4.

y. Test equipment remains connected.

TABLE 5-4

Luminance Level		067-0596-00 Calibration Fixture
Component	**Amplitude**	**V_2 Volts control Tolerance (±1%)**
White[7]	537.5 mV	5-3-47 to 5-4-56
Yellow	481.9 mV	4-7-92 to 4-8-88
Cyan	391.8 mV	3-8-94 to 3-9-72
Magenta	251.3 mV	2-4-98 to 2-5-48
Blue[8]	124.1 mV	1-2-32 to 1-2-57
Red[8]	244.3 mV	2-4-28 to 2-4-77
Magenta[8]	318.4 mV	3-1-64 to 3-2-29
Green[8]	431.6 mV	4-2-92 to 4-3-80
Cyan[8]	505.7 mV	5-0-26 to 5-1-30
Yellow[8]	625.9 mV	6-2-26 to 6-3-53
White[8]	700.0 mV	6-9-58 to 7-1-00

[7]**Set the Type 142 COLOR BAR WHITE REF switch to 75%.**
[8]**Set the Type 142 COLOR BAR AMPL switch to 100%.**

26. Check/Adjust Full Field White Risetime and Aberrations

a. Set the Type 1A5 B Input AC-GND-DC switch to GND, Display switch to A-Vc, Volts/Cm switch to .1 V and rotate the Variable (Volts/Cm) control for a display amplitude of 5 cm between the blanking level and white level.

b. Observing the test oscilloscope display, rotate the Delay-Time Multiplier control to intensify the leading edge of the display between blanking and the white level. Then, set the Horizontal Display switch to A Dly'd.

c. CHECK—Test oscilloscope display; aberrations on the leading top corner of the white bar must be less than or equal to 2% peak to peak of the 5 cm display.

d. Set the test oscilloscope Sweep Magnifier switch to X2.

e. CHECK—Test oscilloscope display; risetime must be 115 ns within 15%.

f. ADJUST—L466 and L456 (see Fig. 5-29) for a risetime of 115 ns within 15%, with less than 2% aberrations.

g. Test equipment remains connected.

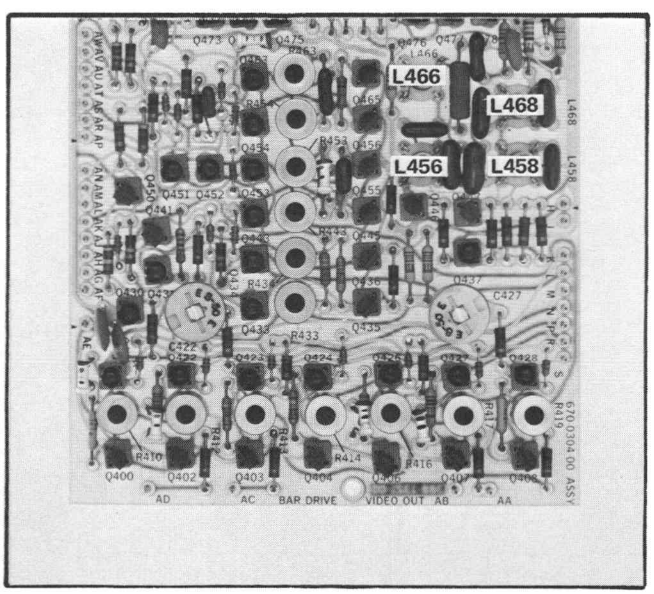


Fig. 5-29. Bar Drive and Video Out board adjustment locations for steps 26 and 30.

27. Check/Adjust Luminance to Chrominance Delay

NOTE

Throughout the Performance Check/Calibration procedure, if only a Performance Check is being performed, the Type 142 dust covers are not removed. To accurately check and/or adjust the Luminance to Chrominance Delay (Step 27) and to Check Chrominance Risetime (Step 28), access to the Type 142 Line Timing and Bar Drive and Video Out boards is necessary.

a. Set the Type 142 POWER switch OFF.

b. Remove the top dust cover (Performance Check Only) from the Type 142. Remove Q683 (see Fig. 5-5) and Q436 (see Fig. 5-26).

c. Set the Type 142 POWER switch ON.

d. Set the Type 142 COLOR BAR U, V, WHITE REF, and AMPL switches up, and the Y switch down.

e. Set the Type 1A5 Variable (Volts/Cm) switch to Cal.

f. Set the test oscilloscope Horizontal Display switch to B Intens By 'A', Sweep Magnifier switch to Off, and the Time Base A Time/Cm switch to .5 µs. Then, observing the test oscilloscope display, rotate the Delay-Time Multiplier control to intensify the display as shown in Fig. 5-30A.

g. Set the test oscilloscope Horizontal Display switch to A Dly'd and the Sweep Magnifier switch to X5.

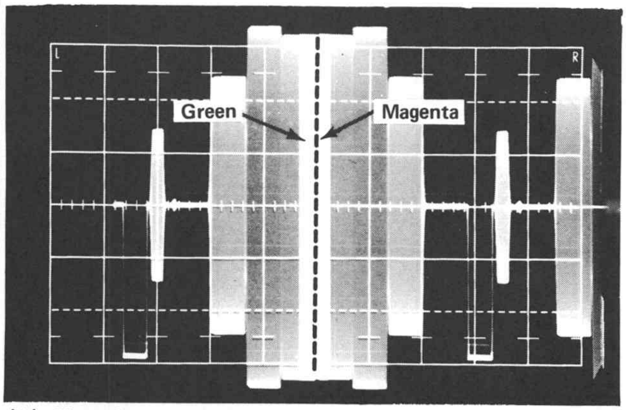
h. Observing the test oscilloscope display, rotate the Horizontal Position controls and the Type 1A5 Position control to center the green-magenta transistion to the center of the graticule as shown in Fig. 5-30B.

NOTE

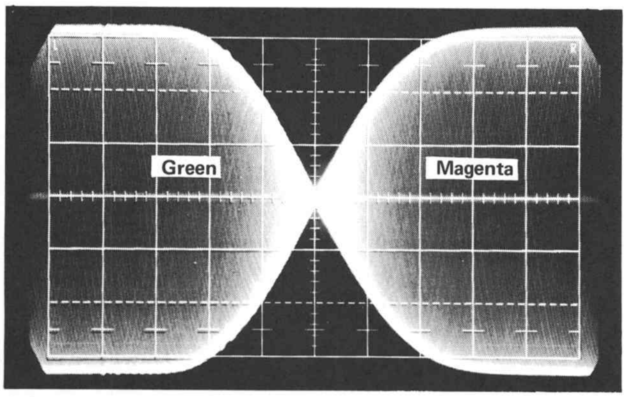
Do not move the test oscilloscope Delay-Time Multiplier or Horizontal Position controls until after the completion of this step.

i. Set the Type 142 COLOR BAR U and V switches down and the Y switch up.

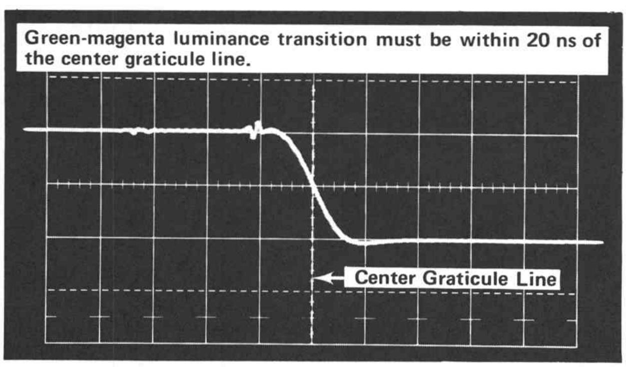
Ⓐ



(A) Chrominance display with green and magenta intensified.



(B) Green-magenta transition properly positioned and centered on graticule.



(C) Luminance signal properly adjusted.

Fig. 5-30. Typical displays to check or adjust luminance to chrominance delay.

j. Observing the test oscilloscope display, set the Type 1A5 Volts/Cm switch to 20 mV and use the Comparison Voltage Amplitude control with +Polarity to position the display into view. Set the Variable (Volts/Cm) control for a display amplitude of 2 cm. Position the display vertically until the 50% point of the green-magenta luminance transition is at the center vertical graticule line on the test oscilloscope, as shown in Fig. 5-30C.

k. CHECK—Test oscilloscope display; green-magenta transistion (at the 50% point) must be within 20 ns of the reference established in part h.

l. ADJUST—R235 (see Fig. 5-27) until the 50% point on the green-magenta transistion is at the same point as the reference established in part h.

m. Set the Type 1A5 Polarity switch to 0.

n. Test equipment remains connected.

28. Check Chrominance Risetime

a. Set the Type 142 COLOR BAR U and V switches up and the Y switch down.

b. Set the test oscilloscope Horizontal Display switch to B Intens By 'A' and the Sweep Magnifier switch to Off.

c. Set the Type 1A5 Variable (Volts/Cm) control for a display amplitude of 5 cm between the blanking level and the flat top portion of the first color bar.

d. Observing the test oscilloscope display, rotate the Delay-Time Multiplier control to intensify the start of the first color bar. Then, set the Horizontal Display switch to A Dly'd and the Sweep Magnifier switch to X5.

e. CHECK—Test oscilloscope display; risetime of chrominance must be 375 ns within 15%.

f. Set the Type 142 POWER switch to OFF.

g. Replace Q683 and Q436, removed in step 27.

h. Replace the top dust cover (Performance Check only).

i. Test equipment remains connected.

29. Check/Adjust Staircase Level Amplitudes

a. Test equipment required is the same as that shown in Fig. 5-21.

b. Remove the 75 ohm coaxial cable from the Type 142 rear-panel COMP BLANKING connector and reconnect it to the rear-panel HORIZ DRIVE connector.

c. Set the controls as given in the list that follows. If it is necessary to check any of the remaining Type 142 and test oscilloscope control settings, refer to the list that follows Fig. 5-1.

Type 142 Controls

COLOR BAR Y	Up
FULL FIELD	Down
MOD STAIRCASE	
U SUBCARRIER	Down
STEPS	Up
VITS FIELD	BOTH
POWER	ON

Test Oscilloscope Controls

Time Base A	
Triggering Level	CW, pushed in
Triggering	
MODE	Auto
Slope	+
Coupling	AC
Source	Norm
Time/Cm	.5 μs
Time Base B	
Triggering Level	In minus region, pushed in
Triggerng	
Mode	Trig
Slope	—
Coupling	DC
Source	Ext
Time/Cm	10 μs
Horizontal Display	B
Sweep Magnifier	Off
Vertical Amplifier (Type 1A5)	
A Input AC-GND-DC	DC
B Input AC-GND-DC	DC
Volts/Cm	.2 V
Variable (Volts/Cm)	Cal
Display	A-B

067-0596-00 Calibration Fixture Controls

V_1	
Range	0
Volts	0-0-0
V_2	
Range	+1.1 V
Volts	0-0-0

d. Observing the test oscilloscope display, rotate the 067-0596-00 calibration fixture V_2 Volts control until the first staircase level of the lower display aligns with the blanking level of the upper display as shown in Fig. 5-31 (approximately 1-4-04).

e. Set the Type 1A5 Volts/Cm switch to 10 mV.

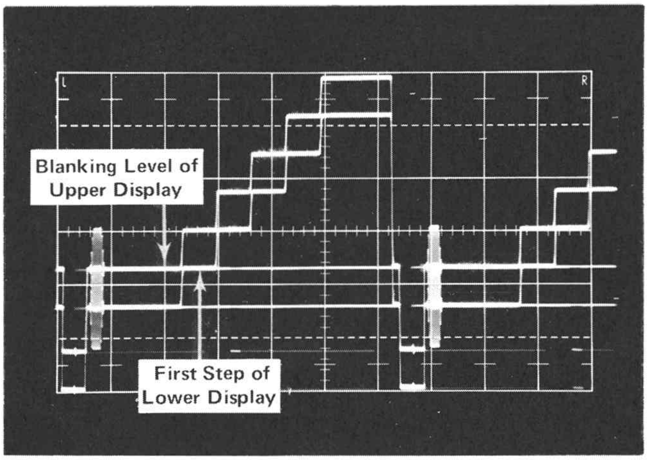


Fig. 5-31. Typical display to check staircase aberrations and risetime.

f. Repeat part d of this step.

g. CHECK—067-0596-00 calibration fixture V_2 Volts control dial setting; dial setting should be between 1-3-90 and 1-4-18 (140 mV, ±1%).

NOTE

Parts g through y check each step of the staircase signal for 140 mV, ±1% between steps, Parts z, aa and ab check the overall amplitude of the staircase signal. For complete calibration proceed to part ac.

h. Set the 067-0596-00 calibration fixture V_2 Volts control for a dial setting of exactly 1-4-04 (140 mV).

i. Set the 067-0596-00 calibration fixture e V_1 Range switch to +1.1 V.

j. Rotate the 067-0596-00 calibration fixture V_1 Volts control for a dial setting of exactly 1-4-04.

NOTE

When the 067-0596-00 calibration fixture Volts controls are set for identical dial settings, the displays on the test oscilloscope appear as one.

k. Rotate the 067-0596-00 calibration fixture V_2 Volts control for a dial setting of exactly 2-8-10 (280 mV).

l. Observing the test oscilloscope display, rotate the 067-0596-00 calibration fixture V_1 Volts control until the first step exactly aligns with the second step.

m. CHECK—067-0596-00 calibration fixture V_1 Volts control dial setting; dial setting should be between 1-3-90 and 1-4-18. (Amplitude between step 1 and 2; 140 mV, ±1%.)

n. Set the 067-0596-00 calibration fixture V_1 Volts control for a dial setting of exactly 2-8-10.

o. Set the 067-0596-00 calibration fixture V_2 Volts control for a dial setting of exactly 4-2-19 (420 mV).

p. Observing the test oscilloscope display, rotate the 067-0596-00 calibration fixture V_1 Volts control until the second step aligns with the third step.

q. CHECK—067-0596-00 calibration fixture V_1 Volts control dial setting; dial setting should be between 2-7-83 and 2-8-38. (Amplitude between step 2 and 3; 140 mV, ±1%.)

r. Set the 067-0596-00 calibration fixture V_1 Volts control for a dial setting of exactly 4-1-19.

s. Set the 067-0596-00 calibration fixture V_2 Volts control for a dial setting of exactly 5-6-28;

t. Observing the test oscilloscope display, rotate the 067-0596-00 calibration fixture V_1 Volts control until the third step aligns with the fourth step.

u. CHECK—067-0596-00 calibration fixture V_1 Volts control dial setting; dial setting must be between 4-1-76 and 4-2-61. (Amplitude between step 3 and 4; 140 mV, ±1%.)

v. Set the 067-0596-00 calibration fixture V_1 Volts control for a dial setting of exactly 5-6-28.

w. Set the 067-0596-00 calibration fixture V_2 Volts control for a dial setting of exactly 7-0-28 (700 mV).

x. Observing the test oscilloscope display, rotate the 067-0596-00 calibration fixture V_1 Volts control until the fourth step aligns with the fifth step.

y. CHECK—067-0596-00 calibration fixture V_1 Volts control dial setting; dial setting must be between 5-5-72 and 5-6-84. (Amplitude between step 4 and step 5; 140 mV, ±1%.)

z. Set the 067-0596-00 calibration fixture V_1 Range switch to 0.

aa. Observing the test oscilloscope display, rotate the 067-0596-00 calibration fixture V_2 Volts control until the fifth step exactly aligns with the blanking level.

ab. CHECK—067-0596-00 calibration fixture V_2 Volts control dial setting; dial setting should be between 6-9-58 and 7-1-00 (700 mV, ±1%).

NOTE

Parts ac through am apply only as a calibration procedure. For performance check, proceed to part an.

ac. Rotate the 067-0596-00 calibration fixture V_2 Volts control for a dial setting of exactly 1-4-04.

ad. ADJUST—R562 (see Fig. 5-32) until the first step aligns with the blanking level (similar to Fig. 5-31).

ae. Repeat part ac, using a dial setting of 2-8-10.

af. ADJUST—R563 (see Fig. 5-32) until the second step aligns with the blanking level.

ag. Repeat part ac, using a dial setting of 4-2-19.

ah. ADJUST—R564 (see Fig. 5-32) until the third step aligns with the blanking level.

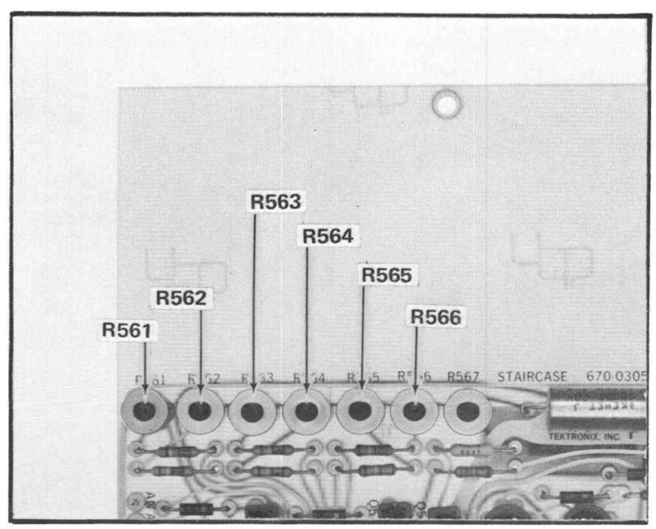


Fig. 5-32. Staircase board adjustment locations.

ai. Repeat part ac, using a dial setting of 5-6-28.

aj. ADJUST—R565 (see Fig. 5-32) until the fourth step aligns with the blanking level.

ak. Repeat part ac, using a dial setting of 7-0-28.

al. ADJUST—R566 (see Fig. 5-32) until the fifth step aligns with the blanking level.

am. Do parts e through ab before proceeding to part an.

an. Test equipment remains connected.

30. Check/Adjust Staircase Risetime and Aberrations

a. Set the Type 1A5 Volts/Cm switch to 20 mV, Display switch to A-Vc, B Input AC-GND-DC switch to GND, and rotate the Variable (Volts/Cm) control for a display amplitude of 5 cm, as indicated on the test oscilloscope, between the blanking level and the first step of the display.

b. Set the test oscilloscope Time Base B Time/Cm switch to 5 µs and rotate the Horizontal Position control to position the first step as shown in Fig. 5-33A.

c. CHECK—Test oscilloscope display; aberrations on the front corner of the first step must be less than or equal to 2% peak to peak of the 5 cm display.

d. Set the test oscilloscope Sweep Magnifier switch to X10.

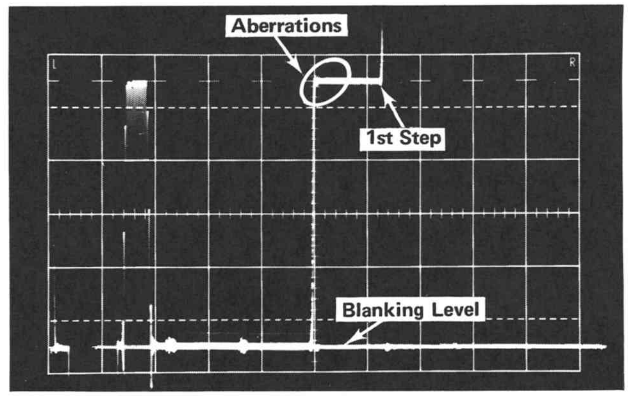
e. CHECK—Test oscilloscope display; risetime must be 260 ns within 15%, as shown in Fig. 5-33B.

f. ADJUST—L468 and L458 (see Fig. 5-29) for a risetime of 260 ns within 15%, with less than 2% peak to peak aberrations.

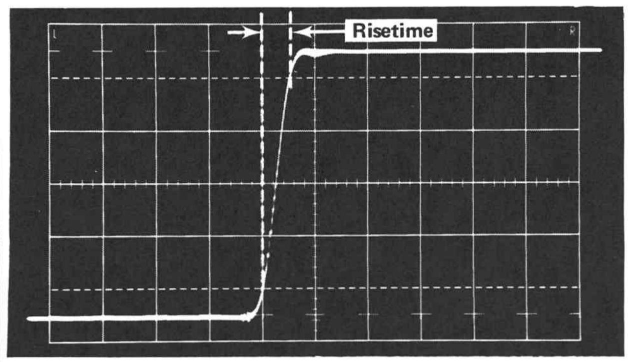
g. Test equipment remains connected.

31. Check/Adjust Staircase Modulation

a. Set the Type 1A5 Volts/Cm switch to .2 V and the Variable (Volts/Cm) switch to Cal.



(A) Preliminary setup required to check risetime and aberrations.



(B) Staircase risetime.

Fig. 5-33. Typical displays to check staircase aberrations and risetime.

b. Set the test oscilloscope Horizontal Display switch to B Intens By 'A', Sweep Magnifier switch to Off, and the Time Base B Time/Cm switch to 10 µs.

c. Set the Type 142 MOD STAIRCASE U SUBCARRIER switch up.

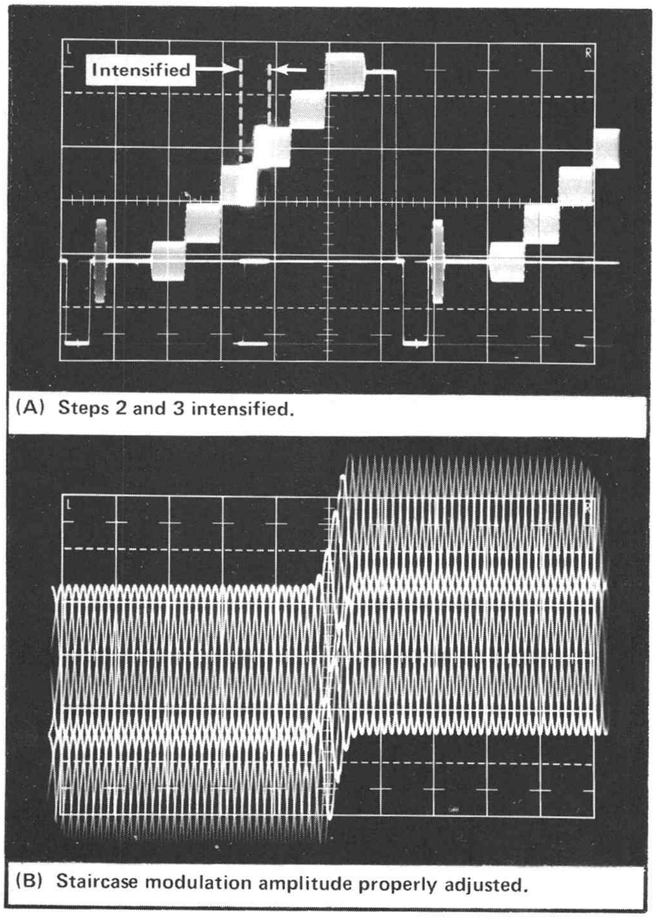
d. CHECK—Test oscilloscope display; 3.57 MHz modulation must be present on the staircase signal.

e. Rotate the test oscilloscope Delay-Time Multiplier control so that the intensified portion of the display is centered on the 2nd and 3rd staircase levels as shown in Fig. 5-34A.

f. Set the test oscilloscope Horizontal Display switch to A Dly'd.

g. Set the 067-0596-00 calibration fixture V_2 Volts control for a dial setting of 1-4-04 (140 mV).

Ⓐ



(A) Steps 2 and 3 intensified.

(B) Staircase modulation amplitude properly adjusted.

Fig. 5-34. Typical displays to check or adjust staircase modulation.

h. Set the Type 1A5 B Input AC-GND-DC switch to DC, Display switch to A-B, Volts/Cm switch to 50 mV, and rotate the Position control to position the display on the test oscilloscope as shown in Fig. 5-34B.

i. Set the test oscilloscope Horizntal Display Sweep Magnifier switch to X2.

j. Observing the test oscilloscope display, rotate the 067-0596-00 calibration fixture V_2 Volts control until the top of the bottom display just meets the bottom of the top display.

k. CHECK—067-0596-00 calibration fixture V_2 Volts control dial setting; dial setting must be between 1-3-90 and 1-4-18 (140 mV, ±3%).

l. Set the 067-0596-00 calibration fixture V_2 Volts control for a dial setting of exactly 1-4-04.

m. ADJUST—R561 (see Fig. 5-32) until the top of the bottom display meets the bottom of the top display.

n. Test equipment remains connected.

32. Check Staircase Modulation Duration

a. Set the Type 142 MOD STAIRCASE STEPS switch down and the test oscilloscope Sweep Magnifier switch to Off.

b. Set the Type 1A5 B Input AC-GND-DC switch to GND, Volts/Cm switch to 20 mV, Display switch to A-Vc, and rotate the Position control to center the display on the test oscilloscope.

c. Set the test oscilloscope Horizontal Display switch to B.

d. Set the Type 1A5 Variable (Volts/Cm) control for a display 2 cm in amplitude, as indicated on the test oscilloscope, between the start of the modulation and the most positive excursion of the modulation.

e. Set the test oscilloscope Sweep Magnifier switch to X2.

f. CHECK—Test oscilloscope display; duration of modulation must be 39 µs within 5% as measured from the 50% points; see Fig. 5-35.

g. Test equipment remains connected.

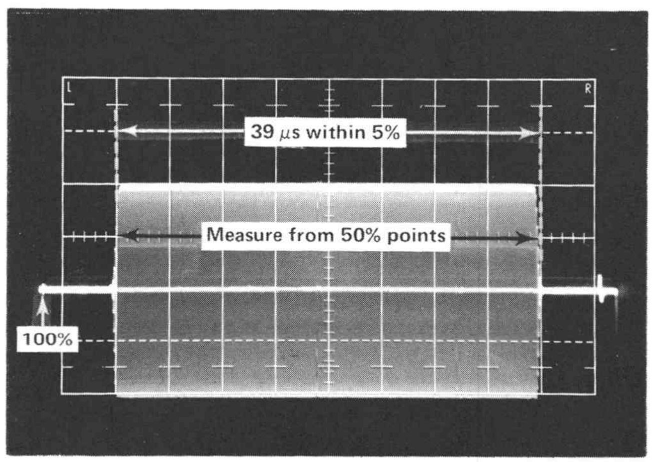


Fig. 5-35. Typical display obtained when checking staircase modulation duration.

33. Check/Adjust Line Timing

a. Set the Type 1A5 Volts/Cm switch to .2 V and the Variable (Volts/Cm) switch to Cal.

b. Set the Type 142 COLOR BAR U and V switches down, FULL FIELD switch up, and the MOD STAIRCASE STEPS switch up.

c. Set the test oscilloscope Horizontal Display switch to B Intens By 'A', Time Base A Time/Cm switch to 2 µs, Sweep Magnifier switch to Off, and rotate the Delay-Time Multiplier control to intensify the display as shown in Fig 5-36A.

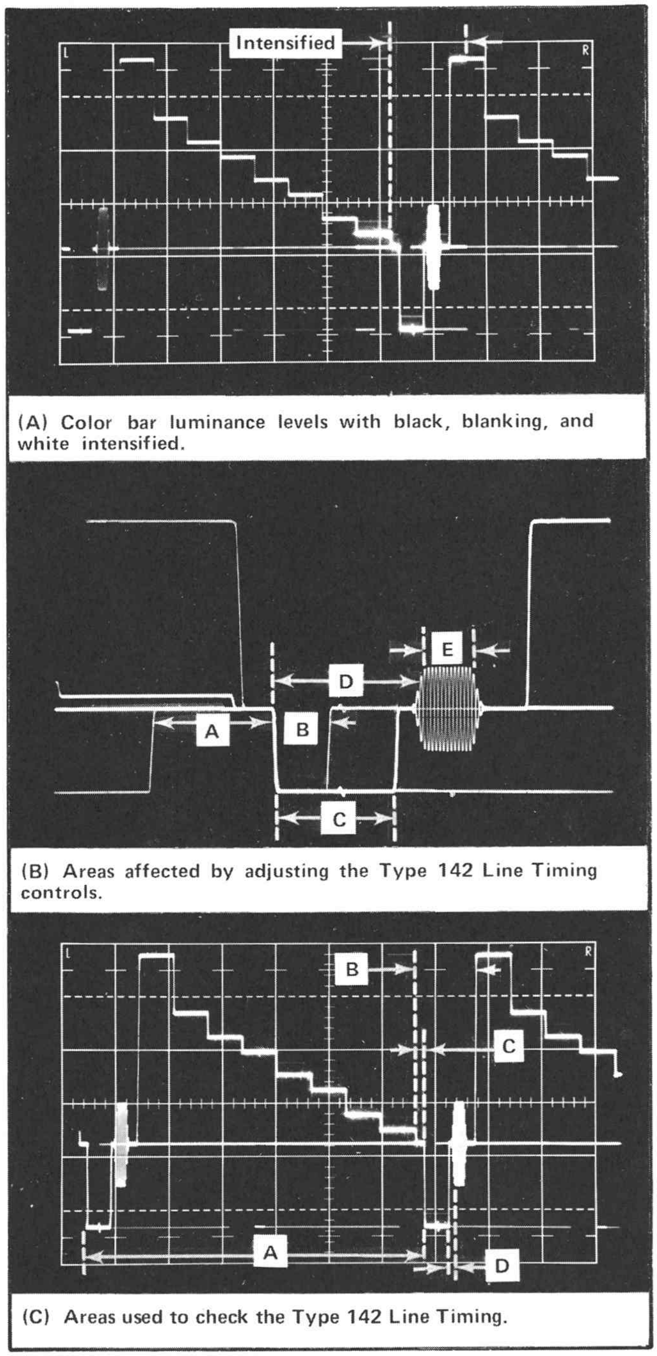
d. Set the test oscilloscope Horizontal Display switch to A Dly'd.

e. CHECK/ADJUST—Using Fig. 5-36B and Fig. 5-37 as guides, check and/or adjust all Line Timing Listed in Table 5-5. For better measurement resolution, the test oscilloscope Time Base A Time/Cm switch may be set to 1 µs and the Type 1A5 Volts/Cm switch to .1 V. Measurements A, B, and C are made between 10% amplitude points; D and E are measured between 50% amplitude points.

f. Set the test oscilloscope Horizontal Display switch to B and the Type 1A5 Volts/Cm switch to .2 V.

g. CHECK—Using Fig. 5-36C as a guide, check all Timing listed in Table 5-6. Use appropriate Time Base B Time/Cm switch positions for performing the Timing measurements. All measurements are made between 10% amplitude points.

h. Test equipment remains connected.



(A) Color bar luminance levels with black, blanking, and white intensified.

(B) Areas affected by adjusting the Type 142 Line Timing controls.

(C) Areas used to check the Type 142 Line Timing.

Fig. 5-36. Typical displays used to check or adjust line timing.

TABLE 5-5

Area Affected (Fig. 5-36B)	Component	Timing		Adjust (Fig. 5-37)
		Exact	Tolerance	
A[9]	Interval between Field Sync Pulses	4.5 µs	4.3 to 4.7 µs	R691
B[9]	Equalizer Pulse Duration	2.33 µs	2.28 to 2.38 µs	R671
C	Line Sync Pulse Duration	4.71 µs	4.66 to 4.76 µs	R661
D	Burst Delay from Horizontal Sync	5.55 µs	5.23 to 5.78 µs	R651
E	Burst Width	2.4 µs	2.22 to 2.61 µs	R641

[9] It may be necessary to advance the test oscilloscope Intensity control to see this portion of this display.

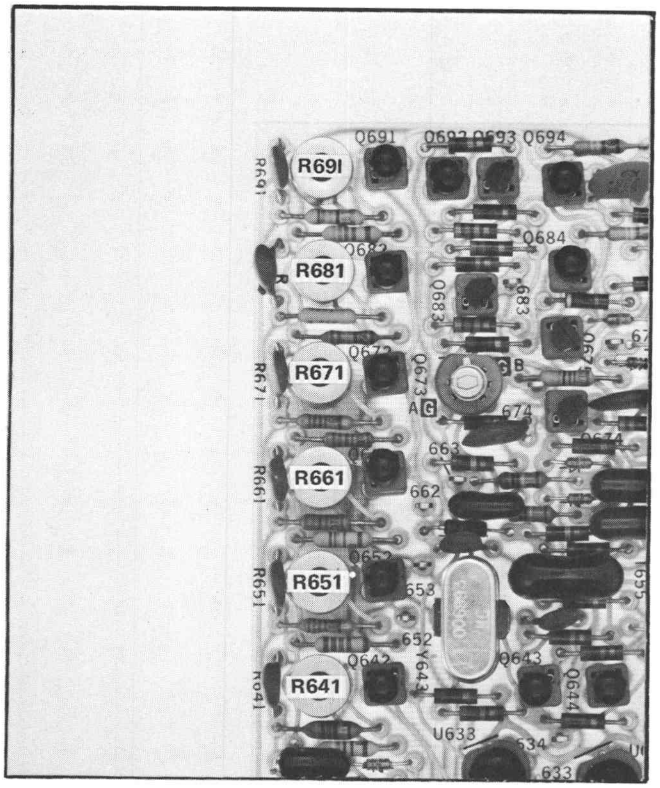


Fig. 5-37. Line Timing board adjustment locations for steps 33 and 43.

TABLE 5-6

Area Affected (Fig. 5-36C)	Component	Timing Check for:
A	Line Period	≈63.5 µs
B	Line Blanking	≈11.1 µs
C	Front Porch	1.54 µs within 0.05 µs
D	Breezeway	At least 500 ns

34. Check Bruch and NTSC Sequence

a. Disconnect the 75 ohm coaxial cable from the Type 142 rear-panel HORIZ DRIVE connector and reconnect it to the rear-panel VERT DRIVE connector.

b. Set the test oscilloscope Horizontal Display switch to B Intens By 'A', Time Base A Time/Cm switch to .2 ms, and the Time Base B Time/Cm switch to 10 ms. Then, set the Horizontal Display switch to A Dly'd after obtaining a triggered display.

c. Using Fig. 5-38 as a guide, determine the field being displayed by the test oscilloscope. If Field 1 is being displayed, leave the Delay-Time Multiplier control as is. If Field 1 is not displayed, set the Delay-Time Multiplier control to display Field 1.

d. CHECK—Test oscilloscope display; burst should not be present on the full line that precedes the first group of equalizing pulses and the full line that follows the second group of equalizing pulses at the points shown in Fig. 5-38A.

e. Set the Type 142 SYNCHRONIZATION BURST BLANKING switch to NTSC SEQ.

f. CHECK—Test oscilloscope display; burst should be present on the lines described in part d of this step.

g. Set the SYNCHRONIZATION BURST BLANKING switch to BRUCH SEQ. Rotate the test oscilloscope Delay-Time Multiplier control until the field blanking interval for Field 2 is displayed.

h. CHECK—Test oscilloscope display; burst should not be present on the full line and the half line that precedes the first group of equalizing pulses (see Fig. 5-38B).

i. Set the SYNCHRONIZATION BURST BLANKING switch to NTSC SEQ.

j. CHECK—Test oscilloscope display; burst should be present on the lines described in part h of this step.

k. Set the SYNCHRONIZATION BURST BLANKING switch to BRUCH SEQ. Rotate the test oscilloscope Delay-Time Multiplier control until the field blanking interval for field 3 is displayed.

l. CHECK—Test oscilloscope display; burst should not be present on the two full lines that follow the second group of equalizing pulses at the points shown in Fig. 5-38C.

m. Set the SYNCHRONIZATION BURST BLANKING switch to NTSC SEQ.

n. CHECK—Test oscilloscope display; burst should be present on the lines described in part l of this step.

o. Set the SYNCHRONIZATION BURST BLANKING switch to BRUCH SEQ. Rotate the test oscilloscope Delay-Time Multiplier control until the field blanking interval for field 4 is displayed.

p. CHECK—Test oscilloscope display; burst should not be present on the half line that precedes the first group of equalizing pulses, and on the second full line that follows the second group of equalizing pulses at the points shown in Fig. 5-38D.

q. Set the SYNCHRONIZATION BURST BLANKING switch to NTSC SEQ.

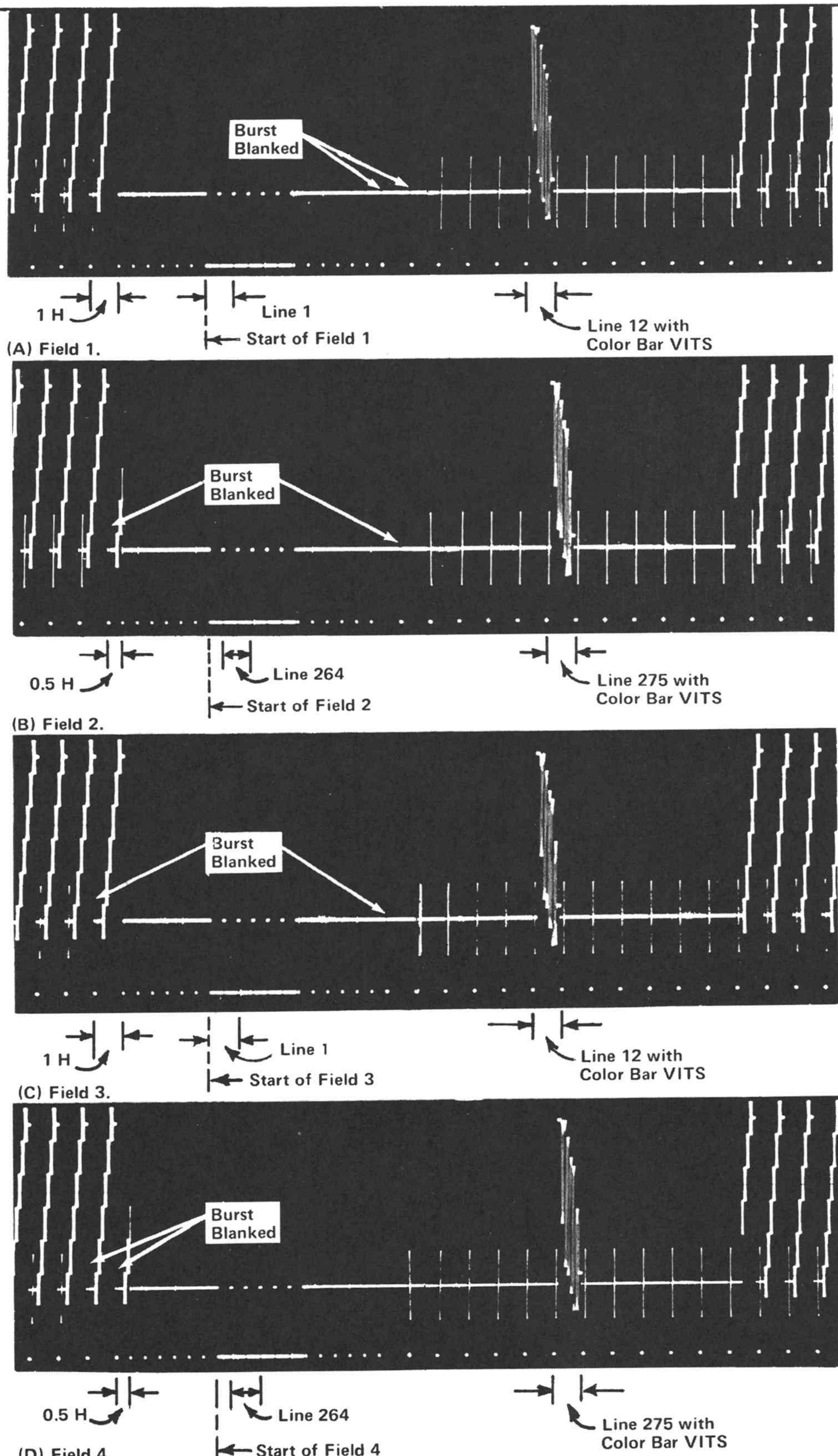


Fig. 5-38. Illustration showing the field blanking interval details. Use this illustration to identify the field number, line number, and Bruch sequence. (For Bruch sequence the Type 142 SYNCHRONIZATION BURST BLANKING switch is set to BRUCH SEQ and burst is blanked at the points indicated on the waveforms. If the switch is set to NTSC SEQ, burst will be present at these same points.)

r. CHECK—Test oscilloscope display; burst should be present on the lines described in part p of this step.

s. Test equipment remains connected.

35. Check VITS

a. Check that (or set) the Type 142 VITS FIELD switch to BOTH and the LINES switch to 12/275. Set the SYNCHRONIZATION BURST BLANKING switch to BRUCH SEQ.

b. Using Fig. 5-38 as a guide, determine the field being displayed on the test oscilloscope.

c. CHECK—Test oscilloscope display; VITS signal must be present, and on the correct line as indicated by the LINES switch.

d. Observing the test oscilloscope display, switch the VITS FIELD switch between 1&3 and 2&4.

e. CHECK—Test oscilloscope display; VITS signal must only be present in that field corresponding to the VITS FIELD switch setting.

f. Rotate the VITS LINES switch from 12/275 through 18/281.

g. CHECK—Test oscilloscope display; VITS signal must be on that line which corresponds to the LINES switch setting.

h. Set the VITS TEST SIGNAL switch to OFF, then COLOR BAR.

i. CHECK—Test oscilloscope display; with VITS TEST SIGNAL switch in OFF, there should be no VITS signal on any field — with VITS TEST SIGNAL switch in COLOR BAR, the VITS signal should be a color bar.

NOTE

With the Type 142 COLOR BAR U AND V switches both set to OFF, the color bar VITS signal will consist of luminance levels only.

j. Repeat parts c through i for the other three fields.

k. Test equipment remains connected.

26. Check/Adjust Output Amplifiers

a. Set the Type 142 COLOR BAR U and V switches up, MOD STAIRCASE U SUBCARRIER switch up, and the VITS FIELD AND TEST SIGNAL switches up.

b. Set the test oscilloscope Horizontal Display switch to A, the Time Base A Time/Cm switch to 10 μs, and the Triggering Slope switch to −.

c. Set the Type 1A5 Volts/Cm switch to 1 V, and the A and B Input AC-GND-DC switches to GND. Then, use the Position control to position the trace vertically 1 cm below the top CRT graticule line.

d. Set the Type 1A5 A Input AC-GND-DC switch to DC.

e. Disconnect the 75 ohm coaxial cable from the Type 142 TEST SIGNAL connector and reconnect it to the COMP SYNC connector.

f. Using Table 5-7, Fig. 5-39, and Fig. 5-40 as guides, CHECK and/or ADJUST the Type 142 output amplifiers.

g. Test equipment remains connected.

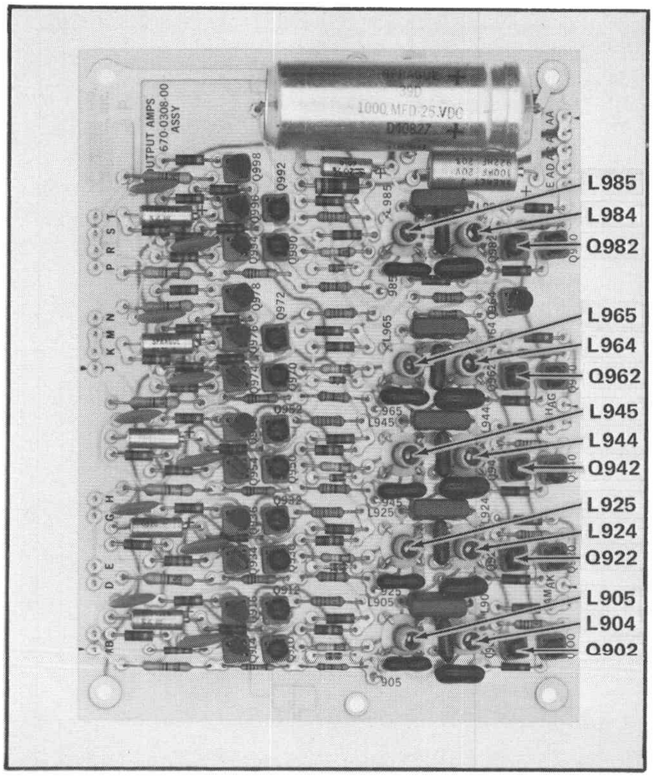


Fig. 5-39. Output Amps board adjustment locations.

TABLE 5-7

TYPE 142 Output Connector (front and/or rear)	Test Oscilloscope Time/Cm Amplitude AT:	Test Oscilloscope Time/Cm Risetime AT:	Test Oscilloscope Time/Cm ADJUST AT:	CHECK FOR: Amplitude (P—P Volts)	CHECK FOR: Risetime (ns)	CHECK FOR: Timing, approximate unless noted otherwise	ADJUST See Fig. 5-39
COMP SYNC	10 μs	.1 μs	1 μs	4 within 0.2 V	115 within 10%	4.7 μs at −4 V within 0.5 μs 58.8 μs at 0 V	L964 & L965
HORIZ DRIVE	10 μs	.1 μs	1 μs	4 within 5%	115 within 10%	6.35 μs at −4 V within 5% 57 μs at 0 V	L1244 & L1245[10]
BURST FLAG	10 μs	-----	.5 μs	4 within 0.2 V	-----	2.3 μs at −4 V within 5% 61.2 μs at 0 V	L904 & L905
COMP BLANKING	10 μs	.1 μs	2 μs	4 within 5%	115 within 10%	11.1 μs at −4 V Line 52.4 μs at 0 V Rate 1.33 ms at −4 V Field 15.33 ms at 0 V Rate	L924 & 925
PAL PULSE	20 μs	.1 μs	1 μs	4 within 0.2 V	115 within 10%	4.7 μs at −4 V within 0.2 μs 58.8 μs at 0 V	L984 & L985
VERT DRIVE	2 ms	.1 ms	5 μs	4 within 5%	115 within 10%	666.7 μs at −4 V 8 ms at 0 V	L944 & L945

[10]See Fig. 5-40 for location of L1244 and L1245.

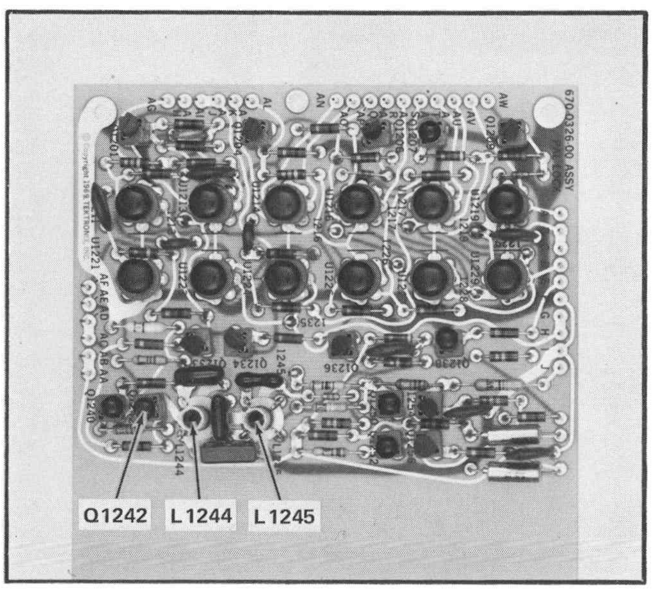


Fig. 5-40. Pal Lock board adjustment locations.

37. Check/Adjust Convergence Amplitudes

a. Disconnect the 75 ohm coaxial cable from the Type 142 rear-panel VERT DRIVE connector and reconnect it to the rear-panel CONVERGENCE PATTERN connector.

Connect a second 75 ohm coaxial cable from the rear-panel HORIZ DRIVE connector to the test oscilloscope Time Base A Trigger Input connector.

b. Set the test oscilloscope Time Base A Time/Cm switch to 10 μs, Triggering Source switch to Ext, Coupling switch to DC, and the Mode switch to Trig.

c. Set the Type 1A5 Volts/Cm switch to .2 V, Variable (Volts/Cm) switch to Cal, Display switch to A-B, and the B Input AC-GND-DC switch to DC.

d. Connect the 75 ohm coaxial cable from the 067-0596-00 calibration fixture Chopped Output connector to the Type 1A5 B Input connector.

e. Set the 067-0596-00 calibration fixture V_1 Range switch to −1.1 V, V_2 Range switch to +1.1 V, and the V_1 and V_2 Volts controls for dial settings of 5-0-20 each (1 V).

f. Set the Type 1A5 Volts/Cm switch to 20 mV.

g. Observing the test oscilloscope display, rotate the 067-0596-00 calibration fixture V_2 Volts control until the top of the bottom display just aligns with the sync tip of the upper display.

h. CHECK—067-0596-00 calibration fixture V_2 Volts control dial setting; dial setting must be between 4-5-22 and 5-5-27 (1 V, ±5%).

i. Set the V_2 Volts control for a dial setting of 5-0-20.

j. ADJUST—R729; see Fig. 5-41, until the top of the bottom display just aligns with the sync tip of the upper display.

k. Disconnect the 75 ohm coaxial cable from the Type 142 rear-panel CONVERGENCE PATTERN connector and reconnect it to the CONVERGENCE PATTERN connector.

l. Repeat parts g and h.

m. Set the Type 1A5 Volts/Cm switch to .2 V.

n. Set the 067-0596-00 calibration fixture V_1 and V_2 Volts controls for dial settings of 3-5-16 each (700 mV).

o. Set the Type 1A5 Volts/Cm switch to 50 mV.

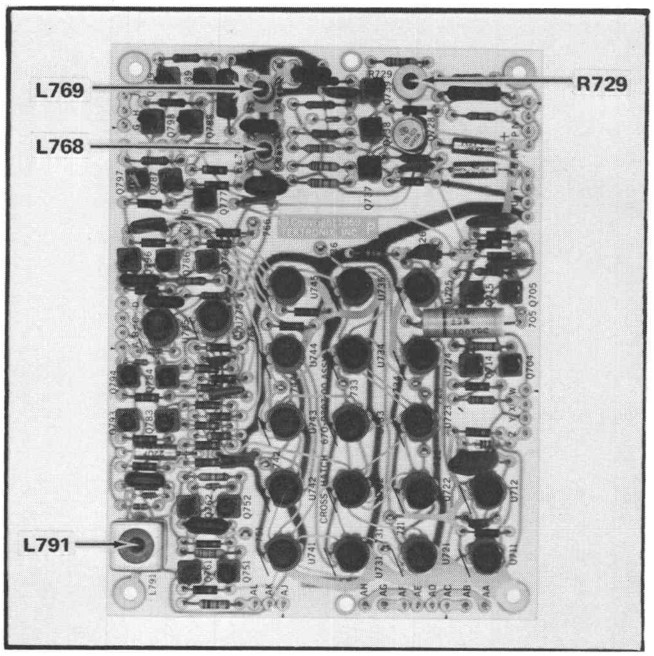


Fig. 5-41. Crosshatch board adjustment locations.

p. Observing the test oscilloscope display, rotate the 067-0596-00 calibration fixture V_2 Volts control until the top of the bottom display just aligns with the blanking level of the upper display.

q. CHECK—067-0596-00 calibration fixture V_2 Volts control dial setting; dial setting should be between 3-1-62 and 3-8-66 (700 mV, ±5%).

r. Repeat part m.

s. Set the 067-0596-00 calibration fixture V_1 and V_2 Volts controls for dial settings of 1-5-05 each (300 mV).

t. Repeat part o.

u. Observing the test oscilloscope display, rotate the 067-0596-00 calibration fixture V_2 Volts control until the blanking level of the lower display just aligns with the sync tip of the upper display.

v. CHECK—067-0596-00 calibration fixture V_2 Volts control dial setting; dial setting should be between 1-3-54 and 1-6-55 (300 mV, ±5%).

w. Repeat part m.

x. Set the 067-0596-00 calibration fixture V_1 and V_2 Volts controls for dial settings of 0-2-50 each (50 mV).

y. Set the Type 1A5 Volts/Cm switch to 10 mV.

z. Observing the test oscilloscope display, rotate the 067-0596-00 calibration fixture V_2 Volts control until the setup level of the bottom display just aligns with the blanking level of the upper display.

aa. CHECK—067-0596-00 calibration fixture V_2 Volts control dial setting; dial setting should be between 0-2-25 and 0-2-76 (50 mV, ±5%).

ab. Test equipment remains connected.

38. Check/Adjust Crosshatch Vertical Lines

a. Set the Type 1A5 Volts/Cm switch to .2 V, Display switch to A-Vc, and the B Input AC-GND-DC switch to GND.

b. Set the Type 142 CONVERGENCE CROSSHATCH switch to VERT and the HORIZONTAL POSITION control fully clockwise.

c. CHECK—Test oscilloscope display; there should be 17 vertical line pulses as shown in Fig. 5-42.

d. Set the test oscilloscope Sweep Magnifier switch to X10, and rotate the Horizontal Position control to position the first vertical line pulse within the viewing area of the graticule.

e. Note and record the horizontal distance (time) between the 50% point on the leading edge of setup and the peak of the first vertical line pulse.

f. Rotate the test oscilloscope Horizontal Position control until the 17th vertical line pulse is within the viewing area of the graticule.

g. Note and record the horizontal distance (time) between the peak of the 17th vertical line pulse and the 50% point on the trailing edge of setup.

h. CHECK—Test oscilloscope display; horizontal distance (time) noted in parts e and g should be the same.

i. ADJUST—L791; see Fig. 5-41, until the time between the 17th pulse and the trailing edge of setup (see part g) matches the time between the leading edge of setup and the peak of the first vertical line (see part e).

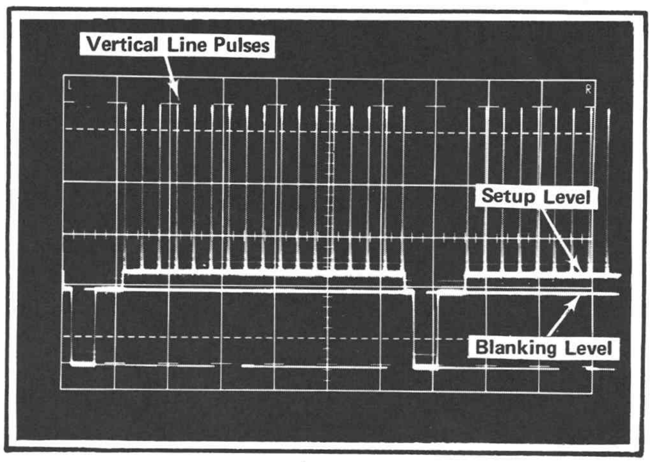


Fig. 5-42. Typical test oscilloscope display showing vertical line pulses.

j. Rotate the test oscilloscope Horizontal Position control to align one of the vertical line pulses with a major vertical graticule line on the test oscilloscope.

k. Observing the test oscilloscope display, rotate the Type 142 HORIZ POSITION control fully counterclockwise.

l. CHECK—Test oscilloscope display; vertical line pulse must have moved at least 3.2 μs from the reference established in part j.

m. Set the Type 1A5 Volts/Cm switch to .1 V and rotate the Variable (Volts/Cm) control for a display amplitude of 4 cm between the setup level and the peak of the vertical line pulse.

n. Set the test oscilloscope Time Base A Time/Cm switch to 2 μs.

o. CHECK—Test oscilloscope display; vertical line pulse duration must be 225 ns within 15% as measured from the 50% amplitude points.

p. Set the test oscilloscope Sweep Magnifier switch to X5, and rotate the Horizontal Position control to position two pulses within the viewing area of the test oscilloscope graticule.

q. Set the Type 142 CONVERGENCE DISPLAY switch to BOTH.

r. CHECK—Test oscilloscope display; dot pulse must have been added to the display. Also, the dot pulse should be approximately midrange between the vertical line pulses.

s. Set the Type 142 CONVERGENCE DISPLAY switch to DOT.

t. CHECK—Test oscilloscope display; vertical line pulse must have been removed.

u. Set the test oscilloscope Sweep Magnifier switch to X10.

v. CHECK—Test oscilloscope display; dot pulse duration must be 350 ns within 15% as measured at the 50% points on the pulse.

w. Test equipment remains connected.

39. Check Crosshatch Horizontal Lines

a. Set the Type 1A5 Volts/Cm switch to .2 V and the Variable (Volts/Cm) control to Cal.

b. Set the test oscilloscope Time Base A Time/Cm switch to 5 ms and the Sweep Magnifier switch to X2.

c. Disconnect the 75 ohm coaxial cable from the Type 142 rear-panel HORIZ DRIVE connector and reconnect it to the VERT DRIVE connector.

d. Set the Type 142 CONVERGENCE CROSSHATCH switch to HORIZ, DISPLAY switch to CROSSHATCH, and the VERT POSITION control fully clockwise.

e. CHECK—Test oscilloscope display; there should be 14 horizontal line pulses per field.

f. Set the test oscilloscope Sweep Magnifier switch to X10 and rotate the Horizontal Position control to position one of the pulses to a major graticule line.

g. Observing the test oscilloscope display, rotate the Type 142 VERT POSITION control fully counterclockwise.

h. CHECK—Test oscilloscope display; horizontal line pulse must have moved at least 1.1 ms from the reference established in part f.

i. Test equipment remains connected.

40. Check/Adjust Convergence Risetime

a. Disconnect the 75 ohm coaxial cable from the Type 142 rear-panel VERT DRIVE connector and reconnect it to the HORIZ DRIVE connector.

b. Set the test oscilloscope Time Base A Time/Cm switch to 2 μs and the Sweep Magnifier switch to Off.

c. Observing the test oscilloscope display, set the Type 1A5 Volts/Cm switch to .1 V and rotate the Variable (Volts/Cm) control for a display amplitude of five cm between the blanking level and the top of the horizontal line pulse.

d. Set the test oscilloscope Sweep Magnifier switch to X10.

e. CHECK—Test oscilloscope display; risetime must be 115 ns within 10%.

f. ADJUST—L768 and L769; see Fig. 5-41, for the best square corner on the leading edge of the pulse.

g. Repeat part e.

h. Disconnect all test equipment and connections.

NOTES

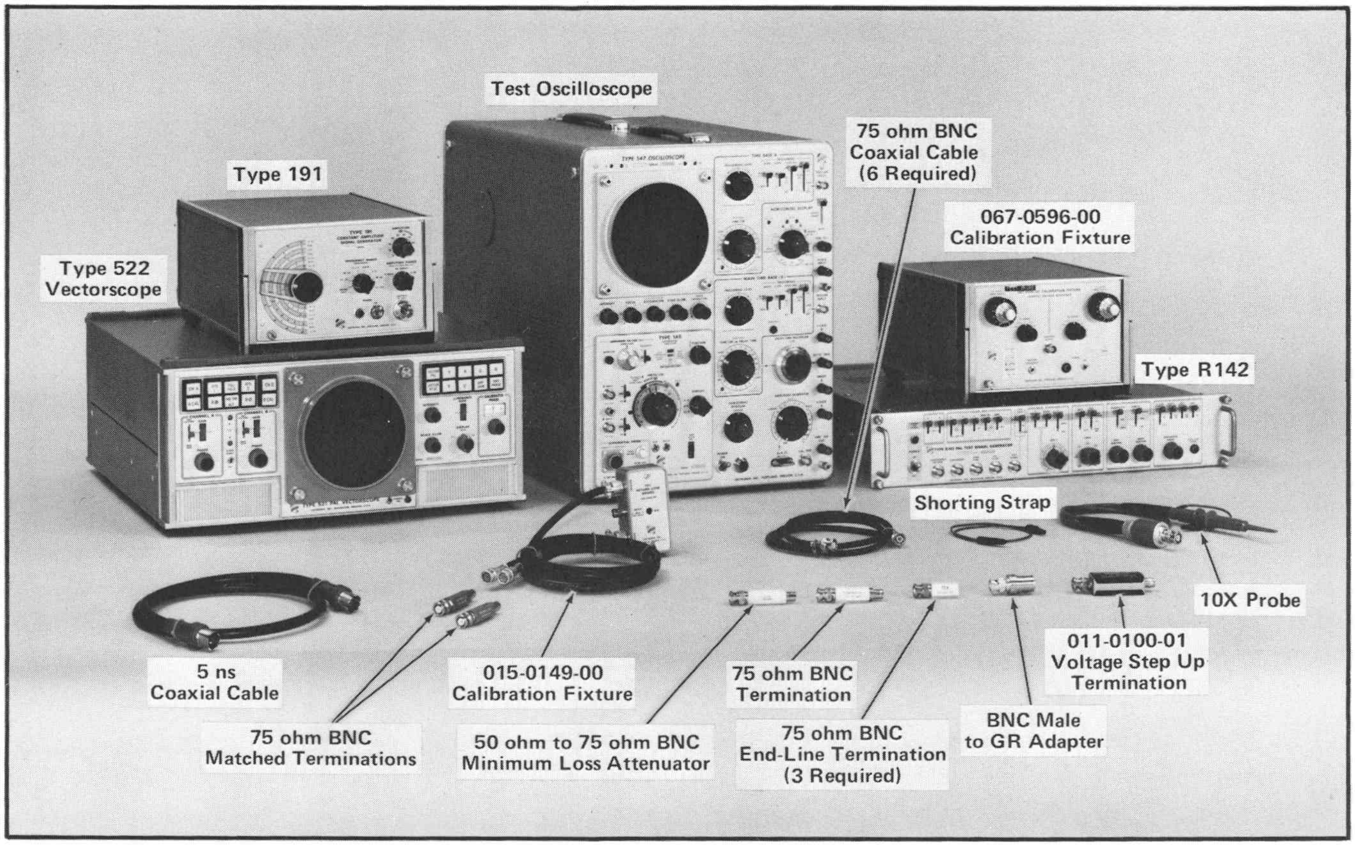


Fig. 5-43. Test equipment required for steps 41 through 48.

41. (Calibration Procedure Only) Check Instrument Return Loss

a. Test equipment is shown in Fig. 5-43.

b. Set the controls as given in the list that follows. If it is necessary to check any of the remaining Type 142 or test equipment control settings, refer to the list that follows Fig. 5-1.

Type 142 Controls

MOD STAIRCASE	
STEPS	UP
VITS	
FIELD	BOTH
CONVERGENCE	
CROSSHATCH	On

Test Oscilloscope Controls

Time Base A	
Triggering Level	CCW, pushed in
Triggering	
Mode	Auto
Slope	+
Coupling	AC
Source	Norm
Time/Cm	.1 ms

Vertical Amplifier (Type 1A5)

A Input AC-GND-DC	AC
B Input AC-GND-DC	AC
Volts/Cm	.1 V
Display	A-B

Vectorscope Controls

Signal Selector	CH A, AΦ, Full Field
Channel A	
100%-75%-Max Gain	Max Gain
Gain	As Is
Phase	As Is
A Cal	Cal
Φ Ref	Ext
Channel B	Not used
Function Selector	Vector Pal
Viewing	As Desired
Display	Both
Calibrated Phase	0
Power	On
Sync	Ext

Type 191 Controls

Frequency	5 MHz
Frequency Range	50 kHz
Amplitude	40
Variable (Amplitude)	Cal

Ⓐ

Amplitude Range	.5-5 V
Power	On

067-0596-00 Calibration Fixture Controls

V_1	
Range	−1.1 V
Volts	3-0-00
V_2	
Range	+1.1 V
Volts	3-0-00

c. Connect one of the matched 75 ohm terminations to the 015-0149-00 calibration fixture Reference coaxial cable. Then, connect the calibration fixture to the Type 1A5 A and B Input connectors.

d. From the Type 191 Constant Amplitude Signal Generator, in order, connect a 5 ns coaxial cable, BNC Male to GR adapter, and a 50 ohm to 75 ohm Minimum Loss Attenuator to the Input connector on the calibration fixture.

e. Observing the test oscilloscope display, set the Type 191 for a display amplitude of 5 cm (500 mV).

f. Connect the second 75 ohm termination to the calibration fixture Unknown coaxial cable.

g. Set the Type 1A5 Volts/Cm switch to 1 mV; the Type 191 Frequency Range switch to 3.6-8 MHz.

h. CHECK—Test oscilloscope display; amplitude must be 1 mV peak to peak or less.

i. Remove transistors Q902, Q922, Q942, Q962, Q982 and Q1242 on the Type 142 Output Amplifier and PAL Lock boards; see Figs. 5-39 and 5-40.

j. Disconnect the 75 ohm termination connected in part f; then, connect the Unknown coaxial cable to the Type 142 PAL PULSE connector.

k. Set the Type 1A5 Volts/Cm switch to 5 mV.

l. CHECK—Test oscilloscope display amplitude; must be 15 mV peak to peak or less (30 dB).

m. Repeat part l for the following Type 142 output connectors; COMP SYNC, BURST FLAG, COMP BLANKING, VERT DRIVE, and HORIZ DRIVE.

n. Replace all transistors removed in part i.

o. Set the Type 142 FULL FIELD switch to OFF and the SYNCHRONIZATION REF switch to EXT.

p. Disconnect the Unknown coaxial cable from the Type 142 HORIZ DRIVE connector and reconnect it to the TEST SIGNAL connector.

q. Repeat part l with the Type 142 POWER switch ON then OFF.

r. Set the Type 142 FULL FIELD and SYNCHRONIZATION REF switches up; then, disconnect the Unknown coaxial cable from the TEST SIGNAL connector, and reconnect it to the CONVERGENCE PATTERN CONNECTOR.

s. Repeat part l. (Use the blanking level of the display as the measurement point.)

t. Connect the 75 ohm termination (disconnected in part j) to one of the Type 142 rear-panel Loop-Thru Input connectors. Then, disconnect the Unknown coaxial cable from the CONVERGENCE PATTERN connector and reconnect it to the other Loop-Thru connector associated with the 75 ohm termination.

u. Set the Type 1A5 Volts/Cm switch to 1 mV.

v. CHECK—Test oscilloscope display amplitude; must be 2.5 mV peak to peak or less (46 dB).

w. Repeat parts t and v for the other two remaining Loop-Thru connectors.

x. Set the Type 142 POWER switch OFF.

y. Using a shorting strap, short L1197 (located on the Subcarrier Output board; see Fig. 5-44).

z. Disconnect the Unknown coaxial cable from the Loop-Thru connector and reconnect it to the SUB-CARRIER connector.

aa. Set the Type 1A5 Volts/Cm switch to 5 mV.

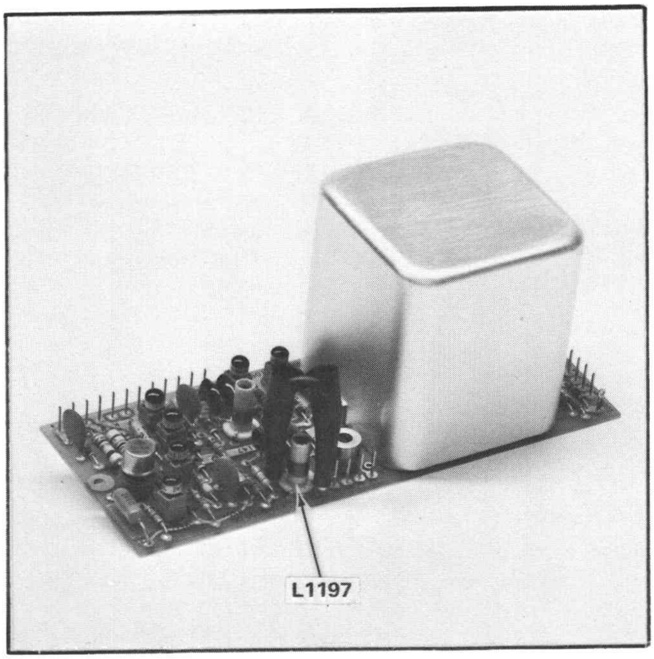


Fig. 5-44. L1197 on the Subcarrier Output board shorted.

ab. Set the Type 142 POWER switch to ON.

ac. CHECK—Test oscilloscope display amplitude; must be 15 mV peak to peak or less (30 dB).

ad. Disconnect the 015-0149-00 calibration fixture from the Type 1A5 and Type 142. Remove the short connected in part y.

42. Check Jitter

a. Set the Type 1A5 Volts/Cm switch to .5 V, A Input AC-GND-DC switch to DC, B Input AC-GND-DC switch to GND, and the Display switch to A-Vc.

b. Set the test oscilloscope Time Base A Time/Cm switch to .1 μs, Triggering Mode switch to Trig, Triggering Slope switch to −, Triggering Coupling switch to DC, and the Triggering Source switch to Ext.

c. From the Type 142 SUBCARRIER connector, connect a 75 ohm coaxial cable and a 75 ohm termination to the Type 1A5 A Input connector. Connect a second 75 ohm coaxial cable from the Type 142 COMP SYNC connector to the test oscilloscope Time Base A Trigger Input connector.

d. Rotate the test oscilloscope Triggering Level control for a triggered display. Then, set the Sweep Magnifier switch to X10.

e. CHECK—Test oscilloscope display; jitter must be 4 ns or less.

f. Disconnect the two 75 ohm coaxial cables and the 75 ohm termination.

43. Adjust External Sync Position

a. Connect 75 ohm end-line terminations to the Type 142 rear-panel Loop-Thru SUBCARRIER and PAL PULSE Input connectors.

b. From another Type 142 (other than the Type 142 under test), connect 75 ohm coaxial cables from the following output connectors to the respective rear-panel Loop-Thru Input connectors on the Type 142 under test; Subcarrier, Pal Pulse, and Comp Sync.

c. From the Type 142 (under Test) COMP SYNC connector, connect a 75 ohm coaxial cable and a 75 ohm termination to the Type 1A5 A Input connector. From the rear-panel unused Loop-Thru COMP SYNC Input connector, connect a 75 ohm coaxial cable and a 75 ohm termination the the Type 1A5 B Input connector. Connect a 75 ohm coaxial cable from the rear-panel COMP BLANKING connector to the test oscilloscope Time Base A Trigger Input connector.

d. Set the test oscilloscope Time Base A Time/Cm switch to 2 μs and the Sweep Magnifier switch to X2.

e. Set the Type 142 (under test) SYNCHRONIZATION REF switch to EXT.

f. Set the Type 1A5 Display switch to A-B and the Volts/Cm switch to 1 V.

g. ADJUST—R681; see Fig. 5-37, to null the first spike on the display.

h. Test equipment remains connected.

44. Check External Inputs

(For Performance Check, connect equipment as given in step 43, parts a through f.)

a. Set the Type 142 (under test) POWER switch OFF, then ON.

Ⓐ

b. CHECK—Test oscilloscope display; must be stable.

c. Set the Type 1A5 Display switch to Vc-B.

d. CHECK—Test oscilloscope display; comp sync must be present.

e. Remove the 75 ohm coaxial cable from the Type 142 (under test) rear-panel Loop-Thru COMP SYNC connector. Disconnect the 75 ohm coaxial cable from the COMP SYNC connector, and reconnect it to the TEST SIGNAL connector.

f. Set the Type 1A5 Volts/Cm switch to .2 V.

g. Set the test oscilloscope Time Base A Time/Cm switch to 10 μs and the Sweep Magnifier switch off.

h. CHECK—Test oscilloscope display; display should consist of only sync and burst.

i. Reconnect the 75 ohm coaxial cable to the rear-panel Loop-Thru COMP SYNC Input connector. (Disconnected in part e.)

j. Set the Type 142 (under test) FULL FIELD switch to OFF.

k. Repeat part h.

l. Set the Type 142 (under test) FULL FIELD switch to the up position, and set the SYNCHRONIZATION TEST SIGNAL switch to NON COMP.

m. CHECK—Test oscilloscope display; sync should have been removed from the display.

n. Disconnect the 75 ohm coaxial cables from the Type 142 rear-panel Loop-Thru Input SUBCARRIER and COMP SYNC connectors.

o. CHECK—Test oscilloscope display; display should consist of sync only.

p. Switch the Type 142 (under test) SYNCHRONIZATION REF switch to INT, and the TEST SIGNAL switch to COMP.

q. Disconnect all test equipment and connections.

45. Check Passive Isolation

a. From the Type 142 TEST SIGNAL connector, connect a 75 ohm coaxial cable and a 75 ohm termination to the Type 1A5 A Input connector. Connect a second 75 ohm coaxial cable from the rear-panel HORIZ DRIVE connector to the test oscilloscope Time Base A Trigger Input connector.

b. From the 067-0596-00 calibration fixture Chopped Output connector, connect a 75 ohm coaxial cable to the Type 1A5 B Input connector.

c. Set the Type 1A5 B Input AC-GND-DC switch to DC and the Display switch to A-B.

d. Set the Type 142 COLOR BAR Y switch down and the MOD STAIRCASE STEPS switch down.

e. Rotate the test oscilloscope Triggering Level control for a triggered display.

f. Observing the test oscilloscope display, rotate the 067-0596-00 V_2 Volts control until the upper and lower cyan color bars just meet.

g. Set the Type 1A5 Volts/Cm switch to 10 mV.

h. Repeat part f.

i. Note and record the total V_1 and V_2 Volts control dial settings. (e.g., 3-0-00 plus 3-0-00 equals 6-0-00, equals 600 mV. Disregard error factor.)

j. Short the Type 142 rear-panel TEST SIGNAL connector to chassis ground.

k. Repeat parts f and i.

l. CHECK—Subtract the total obtained in part k from the total obtained in part l; must be 12 mV or less.

m. Disconnect the 75 ohm coaxial cable from the Type 142 TEST SIGNAL connector and reconnect it to the SUBCARRIER connector. Remove the short connected in part j.

n. Set the 067-0596-00 V_1 and V_2 Range switches to −11 V and +11 V. Set the Volts controls to 1-0-00.

o. Observing the test oscilloscope display, rotate the V_2 Volts control until the top of the bottom display just meets the bottom of the top display.

p. Repeat part i.

q. Short the Type 142 rear-panel SUBCARRIER connector.

r. Repeat parts o and p.

s. CHECK—Subtract the total obtained in part r from the total obtained in part p; must be 40 mV or less.

t. Disconnect the 75 ohm coaxial cable from the SUBCARRIER connector and reconnect it to the COMP SYNC connector. Remove the short connected in part q.

u. Set the Type 1A5 Volts/Cm switch to 1 V.

v. Set the 067-0596-00 V_1 Range switch to 0. Then, observing the test oscilloscope display, repeat parts o and p.

w. Short the Type 142 rear-panel COMP SYNC connector.

x. Repeat parts o and p.

y. CHECK—Subtract the total obtained in part x from the total obtained in part v; must be 70 mV or less.

z. Disconnect the 75 ohm coaxial cable from the COMP SYNC connector, and reconnect it to the PAL PULSE connector. Remove the short connected in part w.

aa. Set the 067-0596-00 V_1 Range switch to −11 V and the V_1 and V_2 Volts controls to 2-0-00.

ab. Set the Type 1A5 Volts/Cm switch to .5 V.

ac. Repeat parts o and p.

ad. Short the Type 142 rear-panel PAL PULSE connector.

ae. Repeat parts o and p:

af. CHECK—Subtract the total obtained in part ae from the total obtained in part ac; must be 70 mV or less.

ag. Disconnect the 75 ohm caoxial cable from the PAL PULSE connector and reconnect it to the CONVERGENCE PATTERN connector. Remove the short connected in part ad.

ah. Set the Type 1A5 Volts/Cm switch to 50 mV.

ai. Set the 067-0596-00 V_1 and V_2 Range switches to −1.1 V and +1.1 V. Set the Volts controls to 5-0-00.

aj. Repeat parts o and p.

ak. Short the Type 142 rear-panel CONVERGENCE PATTERN connector.

al. Repeat parts o and p.

am. CHECK—Subtract the total obtained in part al from the total obtained in part aj; must be 20 mV or less.

an. Disconnect the 75 ohm coaxial cables from the Type 1A5 A and B Input connectors and Type 142. Remove the short connected in part ak.

46. (Calibration Procedure Only) Check Active Isolation

a. Connect a 3.6 MHz signal via a 5 ns coaxial cable and the 50 ohm to 75 ohm minimum loss attenuator to the Type 142 TEST SIGNAL connector.

b. Set the Type 142 COLOR BAR U and V switches to OFF.

c. Connect a properly compensated X10 probe from the Type 1A5 A Input connector to the back side of the Type 142 TEST SIGNAL connector. Set the Type 1A5 Display switch to A-Vc and the B Input AC-GND-DC switch to GND.

d. Observing the test oscilloscope display, adjust the Type 191 Variable (Amplitude) control for 1 volt of 3.6

MHz (2 cm) on the display. Then, disconnect the 10X probe.

e. From the Type 1A5 rear-panel TEST SIGNAL connector, connect a 75 ohm coaxial cable and a 75 ohm termination to the Type 1A5 A Input connector.

f. CHECK—Test oscilloscope display; 3.6 MHz signal must be 10 mV or less.

NOTE

If desired, momentarily remove the 3.6 MHz signal from the Type 142 to define the actual signal.

g. Disconnect the 3.6 MHz signal from the TEST SIGNAL connector and reconnect it to the COMP SYNC connector. Disconnect the 75 ohm coaxial cable from the rear-panel TEST SIGNAL connector and reconnect it to the rear-panel COMP SYNC connector.

h. Set the Type 1A5 Volts/Cm switch to 20 mV and rotate the Position control to vertically position the top portion of the display within the viewing area.

i. CHECK—3.6 MHz signal on the display must be 32 mV or less.

j. Disconnect the 3.6 MHz signal from the Type 142 COMP SYNC connector and reconnect it to the PAL PULSE connector. Remove the 75 ohm coaxial cable from the rear-panel COMP SYNC connector and reconnect it to the PAL PULSE connector.

k. Repeat part i.

l. Disconnect the 75 ohm coaxial cable from the Type 142 rear-panel PAL PULSE connector and reconnect it to the SUBCARRIER connector.

m. Set the Test oscilloscope Time Base A Time/Cm switch to .1 μs and the Triggering Source Switch to Norm.

n. Set the Type 1A5 Volts/Cm switch to .5 V and rotate the Position control to position the top of the display to the CRT center. Then, set the Polarity switch to +, Volts/Cm switch to 10 mV, and rotate the Comparison Voltage Amplitude control to position the display vertically as above. (It may be necessary to retrigger the test oscilloscope.)

o. Disconnect the 3.6 MHz signal from the Type 142 PAL PULSE connector and reconnect it to the SUBCARRIER connector.

p. CHECK—3.6 MHz signal on subcarrier must be 20 mV or less.

q. Disconnect all test equipment and connections.

47. Check Diff Gain and Diff Phase

a. From the Type 522 PAL Vectorscope Channel A J1 connector, connect the 011-0100-01 Voltage Step Up Termination and a 75 ohm coaxial cable to the Type 142 TEST SIGNAL connector.

NOTE

Do not terminate the Type 522 Channel A J1 connector.

b. Connect 75 ohm end-line terminations to the Type 522 Ext Sync J121 and Ext CW Φ Ref J311 connectors.

c. Connect 75 ohm coaxial cables from the Type 522 Ext Sync J120 and Ext CW Φ Ref J310 connectors to the Type 142 COMP SYNC and SUBCARRIER connectors.

d. Observing the Type 522 display, rotate the Channel A Gain control and A Phase control to set the short vector (there will be three vectors) exactly on the compass rose at 180°.

e. Check that all three vectors start at the Type 522 vector graticule center. If they do not, adjust the Vertical and Horizontal Position Clamp controls, then repeat part d.

f. Press the Type 522 Function Selector Diff Gain pushbutton, and rotate the Vertical Position control to position the display as shown in Fig. 5-45A.

g. CHECK—Type 522 display; Diff Gain must be less than or equal to 0.5% as measured on the Diff Gain scale.

h. Set the Type 142 APL% switch to 50/50 and repeat part g.

i. Set the Type 142 APL% switch to 100/90 and repeat part g.

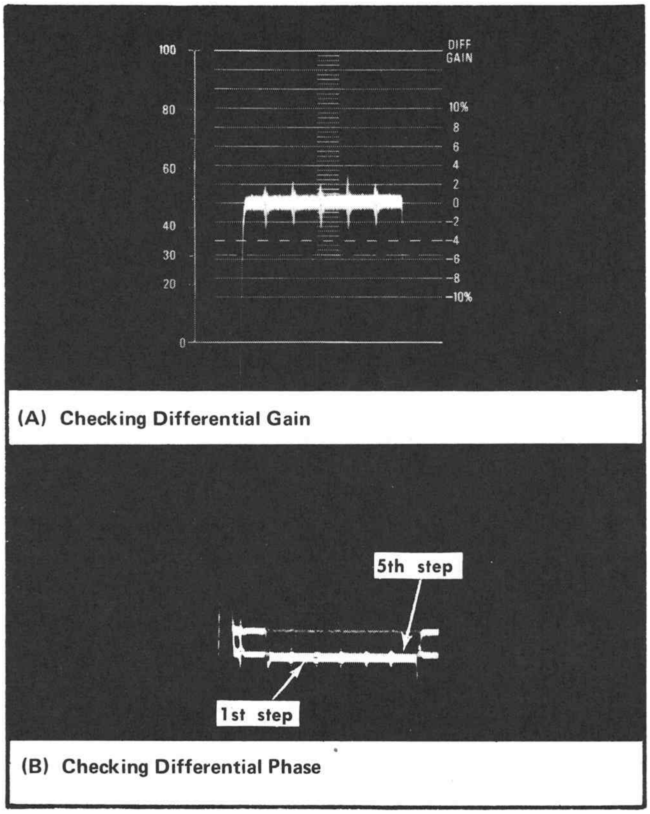


Fig. 5-45. Typical vectorscope displays obtained to check differential gain and phase.

j. Press the Type 522 Function Selector Diff Phase pushbutton.

k. Rotate the Type 522 A Phase control to center the display, and then use the same control as a coarse adjustment to null the first step on the display as shown in Fig. 5-45B.

l. Rotate the Type 522 Calibrated Phase control to again null the first step.

NOTE

The Calibrated Phase control is used as a vernier adjustment.

m. Note and record the Type 522 Calibrated Phase control dial reading.

n. Rotate the Calibrated Phase control to null the fifth step.

o. Note and record the Type 522 Calibrated Phase control dial reading.

p. CHECK—Diff Phase; resultant difference obtained by subtracting dial readings obtained in parts m and o must be 0.1° or less.

q. Set the Type 142 APL% switch to 50/50.

r. Repeat parts k through p.

s. Set the Type 142 APL% switch to 0/10.

t. Repeat parts k through p.

u. Test equipment remains connected.

48. Check V Axis Phasing

a. Disconnect the 011-0100-01 Voltage Step Up Termination from the Type 522 Channel A J1 connector and the 75 ohm coaxial cable. Reconnect the 75 ohm coaxial cable directly to the Channel A J1 connector. Connect a 75 ohm end-line termination to the Channel A J2 connector.

b. Set the Type 142 FULL FIELD switch up and the APL% switch to 0/50.

c. Press the Type 522 Function Selector Vector Pal pushbutton, set the Channel A 100%-75%-Max Gain switch to 75%, and rotate the Channel A Gain control to Cal.

d. Observing the Type 522 display, rotate the A Phase control to align the shortest vector with the 180° axis on the vector graticule.

e. CHECK—Type 522 vector display; all burst and color vectors must be in their correct locations with regard to the vector graticule.

f. Set the Type 142 V AXIS PHASING switch to 90°.

g. If necessary, rotate the Type 522 A Phase control to align the short vector with the 180° axis.

h. CHECK—Type 522 vector display; position of burst and color vectors must be as shown in Fig. 5-46A.

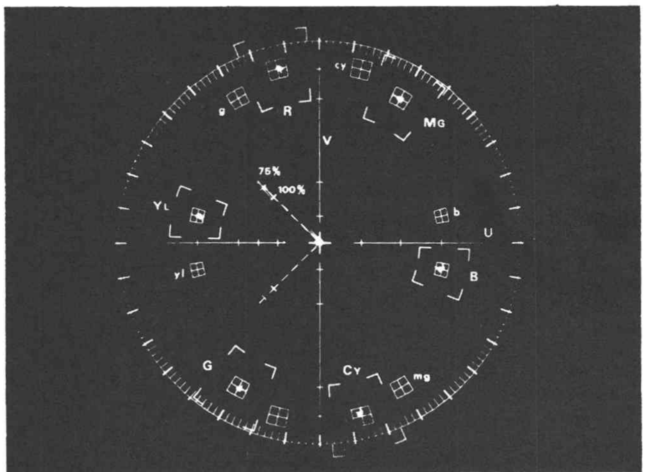
i. Set the Type 142 V AXIS PHASING switch to 270°.

j. Repeat part h.

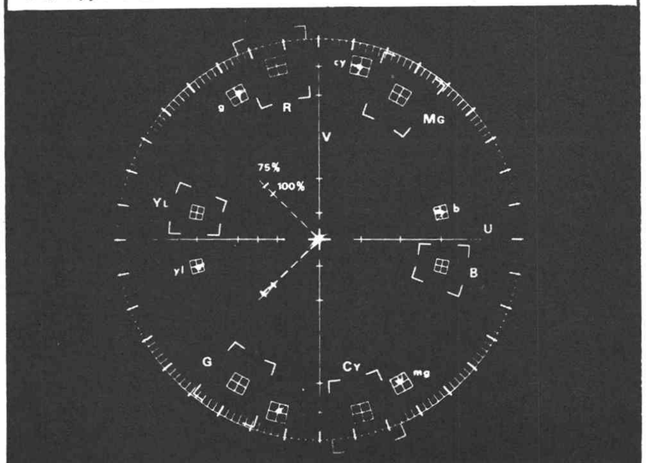
k. CHECK—Type 522 vector display; position of burst and color vectors must be as shown in Fig. 5-46B.

l. Disconnect all test equipment and connections.

This completes the Performance Check/Calibration of the Type 142 PAL TEST SIGNAL GENERATOR. Replace the top and bottom dust covers (Calibration Procedure Only).



(A) Type 142 V AXIS PHASING switch in 90° position.



(B) Type 142 V AXIS PHASING switch in 270° position.

Fig. 5-46. Typical Type 522 PAL displays to check V AXIS PHASING.

NOTES

NOTES

SECTION 6
RACKMOUNTING

Change information, if any, affecting this section will be found at the rear of the manual.

RACKMOUNTING INSTRUCTIONS

Mounting Methods (Figs. 6-1, 6-2, 6-5 and 6-6)

This instrument will fit most commercial consoles and most 19-inch wide racks whose front and rear rail holes conform to Universal, EIA, RETMA and Western Electric hole spacing.

Fig. 6-1 shows the instrument installed in a cabinet type rack with 1 3/4-inch wide slide-out tracks for a non-tilt installation. The instrument is secured into the rack by means of four captive thumb screws. When the thumb screws on the front panel are loosened, the instrument can be pulled out of the rack like a drawer to its fully extended position (see Fig. 6-2). This position permits many routine maintenance functions to be performed without completely removing the instrument from the rack.

The slide-out tracks easily mount to the cabinet rack front and rear vertical mounting rails if the inside distance between the front and rear rails is within 10 1/2 inches to 24 1/2 inches. Some means of support (for example, make extensions for the rear mounting brackets) is needed for the rear ends of the slide-out tracks if the tracks are going to be installed in a cabinet rack whose inside dimension between front and rear rails is not the proper distance (10 1/2 inches to 24 1/2 inches).

Instrument Dimension

The last page in this section shows dimensional drawings exclusive of the power cord and cables.

Width—A standard 19-inch rack may be used. The dimension or opening between the front rails must be at least 17 5/8 inches (see Fig. 6-2) for a cabinet rack in which the front lip of the stationary section is mounted behind an untapped front rail as shown in the right-hand illustration of Fig. 6-6. This dimension allows room on each side of the instrument for the slide-out tracks to operate so the instrument can move freely in and out of the rack.

Depth—For proper circulation of cooling air, allow at least 2 inches clearance behind the rear of the instrument and any enclosure on the rack (see dimensional drawing). If it is sometimes necessary or desirable to operate the Type R142 in the fully extended position, use cables that are long enough to reach from the instrument to the location where the signal(s) need to be applied.

Rackmounting in a Cabinet Rack

General Information—The slide-out tracks for the instrument consist of two assemblies, one for the left side of the instrument and one for the right side. Each assembly consists of three sections as illustrated in Fig. 6-3. The stationary section attaches to the front and rear rails of the rack with inside dimensions as indicated in Fig. 6-2; the chassis section attaches to the instrument and is installed at the factory; the intermediate section fits between the other two sections to allow the instrument to be fully extended out of the rack.

The small hardware components included with the slide-out track assemblies are shown in Fig. 6-4. The hardware shown in Fig. 6-4 is used to mount the slide-out tracks to the rack rails having this compatibility.

(a) Front and rear rail holes must be large enough to allow inserting a 10-32 screw through the rail mounting holes (see Fig. 6-6).

(b) Front rail holes may have already been countersunk prior to this installation.

Because of the compatibility given in (b), there will be some screws left over.

The stationary and intermediate sections for both sides of the rack are shipped as a matched set and should not be separated. The matched sets for both sides including hardware are marked 351-0195-00 on the package. To identify the assemblies, note that the automatic latch and intermediate section stop are located near the top of the matched sets when they are properly mated to the chassis sections as shown in Fig. 6-3.

Mounting Procedure—Use the following procedure to mount both sets. See Figs. 6-5 and 6-6 for installation details.

1. To mount the instrument directly above or below another instrument in the cabinet rack, select the appropriate holes in the front rack rails for the stationary sections using Fig. 6-5 as a guide.

2. Mount the stationary slide-out track sections to the front rack rails using either of these methods:

(a) If the front rails are **not** countersunk, use the pan head screws and bar nuts to mount the stationary sections similar to the right-hand illustration shown in Fig. 6-6.

(b) If the front rails **are** countersunk, use the flat head screws and bar nuts to mount the stationary sections as shown in Fig. 6-6 right-hand illustration.

3. Mount the stationary slide-out track sections to the non-tapped rear rails using this method:

Mount the left stationary section with hardware provided as shown in the left-hand or center illustration in Fig. 6-6. Note that the rear mounting bracket can be installed either way so the slide-out tracks will fit a deep or shallow cabinet rack. Use Fig. 6-6 as a guide for mounting the right stationary section. Make sure the stationary sections are horizontally aligned so they are level and parallel with each other.

Adjustments

To adjust the slide-out tracks for smooth operation, proceed as follows:

1. Insert the instrument into the rack as described and as shown in steps 1 through 4 of Fig. 6-7 installation procedure.

2. Adjust the slide-out tracks for proper spacing as shown in Fig. 6-8.

Maintenance

The slide-out tracks require no lubrication. The special dark gray finish on the sliding parts is a permanent lubrication.

NOTES

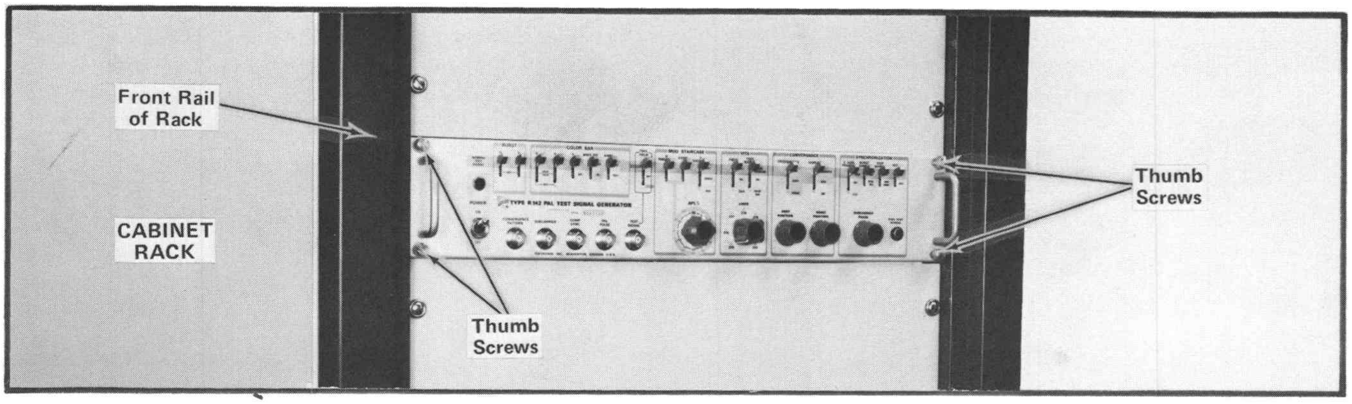


Fig. 6-1. The Type R142 installed in a cabinet type rack.

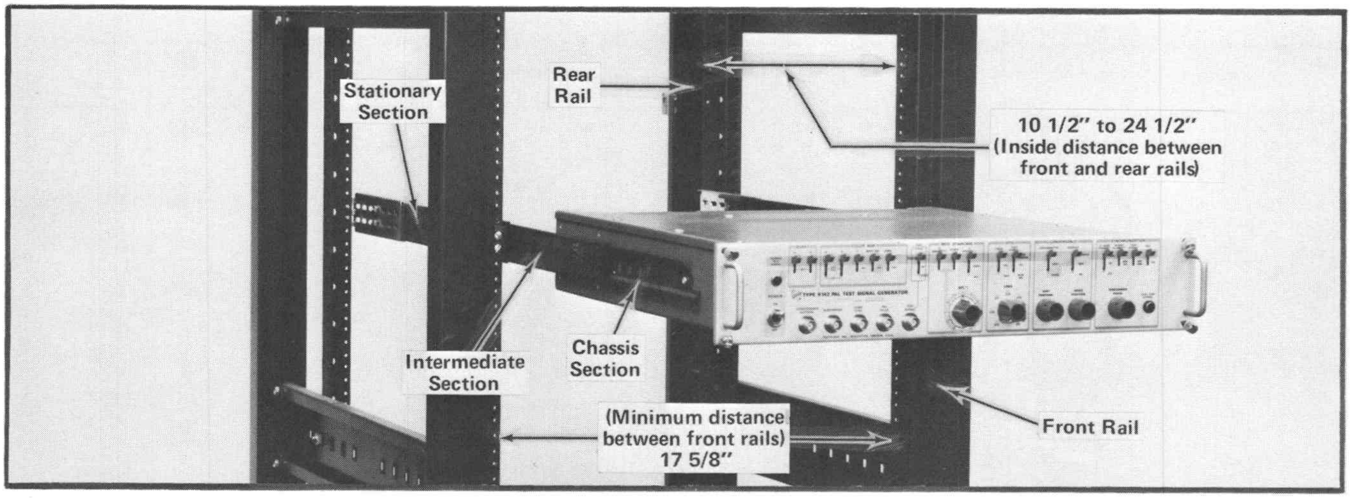


Fig. 6-2. The Type R142 shown in the fully extended position. The cabinet rack sides have been removed from the rack to show mounting.

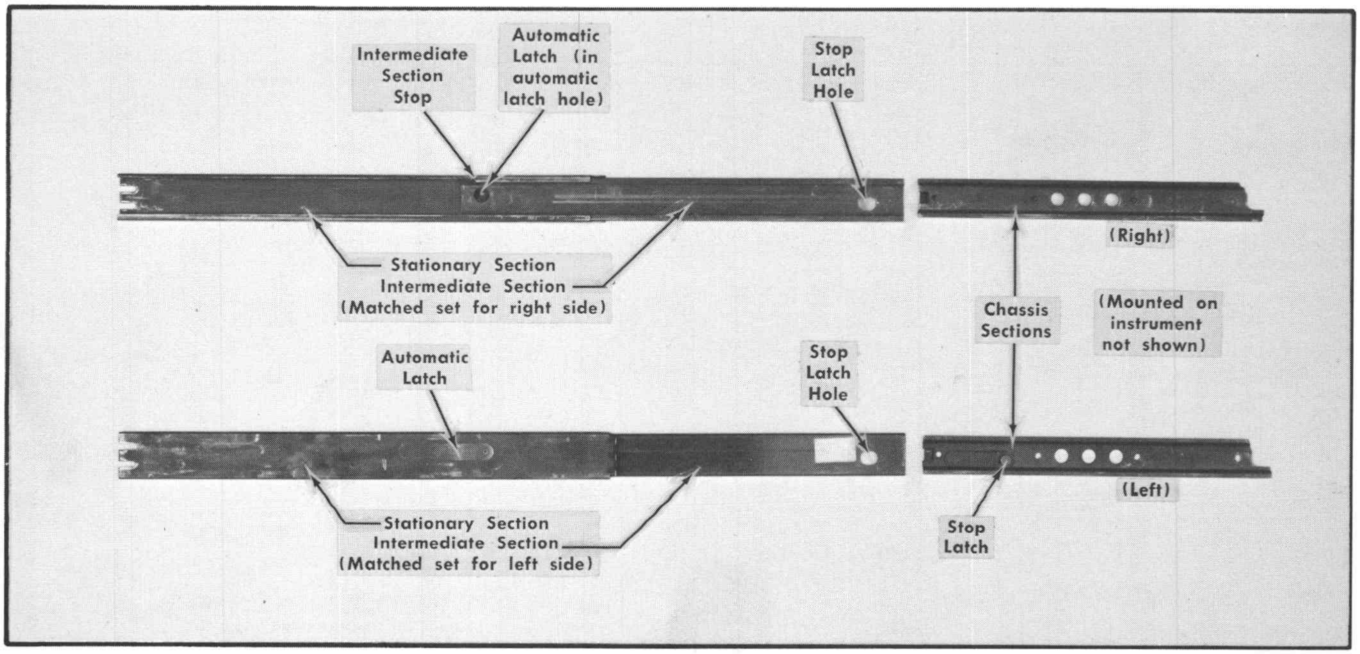


Fig. 6-3. Illustration showing the 1 3/4-inch wide slide-out track assemblies.

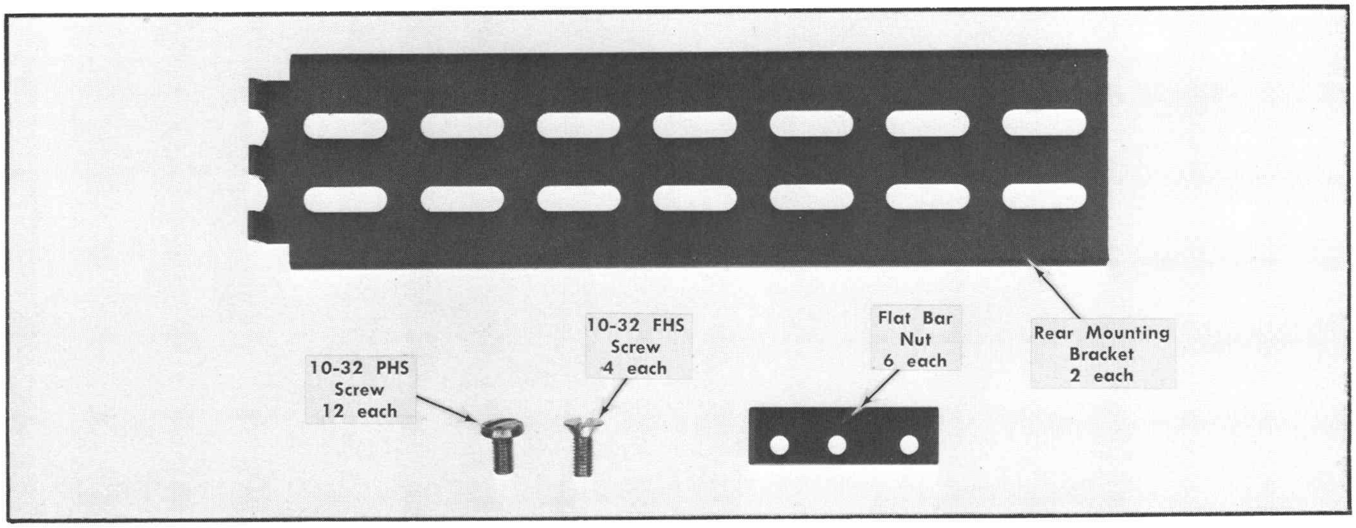


Fig. 6-4. Small hardware components for mounting the stationary sections to the rack rails.

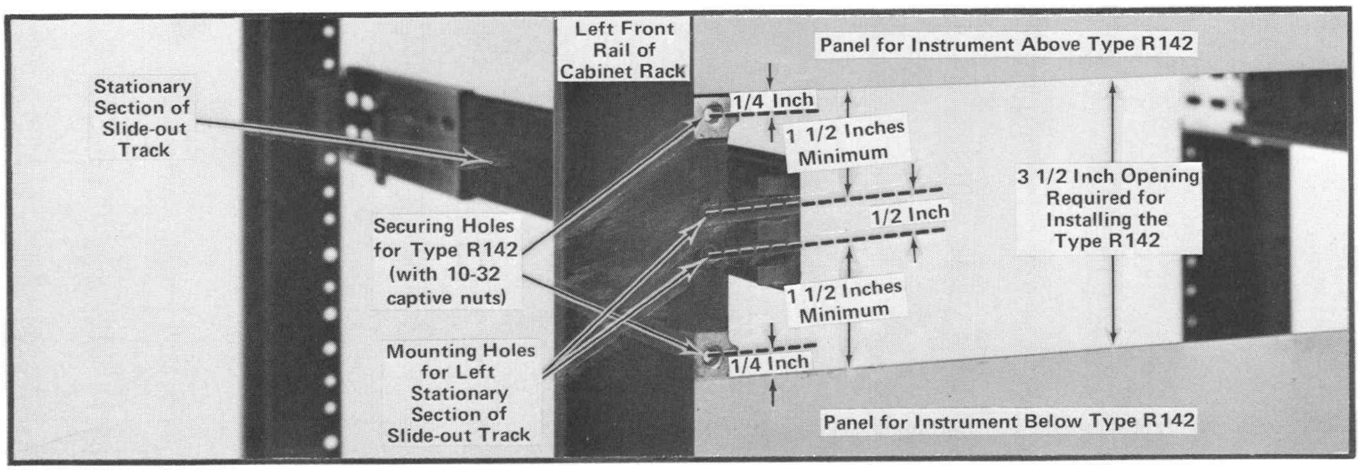


Fig. 6-5. Vertical mounting position of the left stationary section and location of the securing holes. These same dimensions apply to the right front rail.

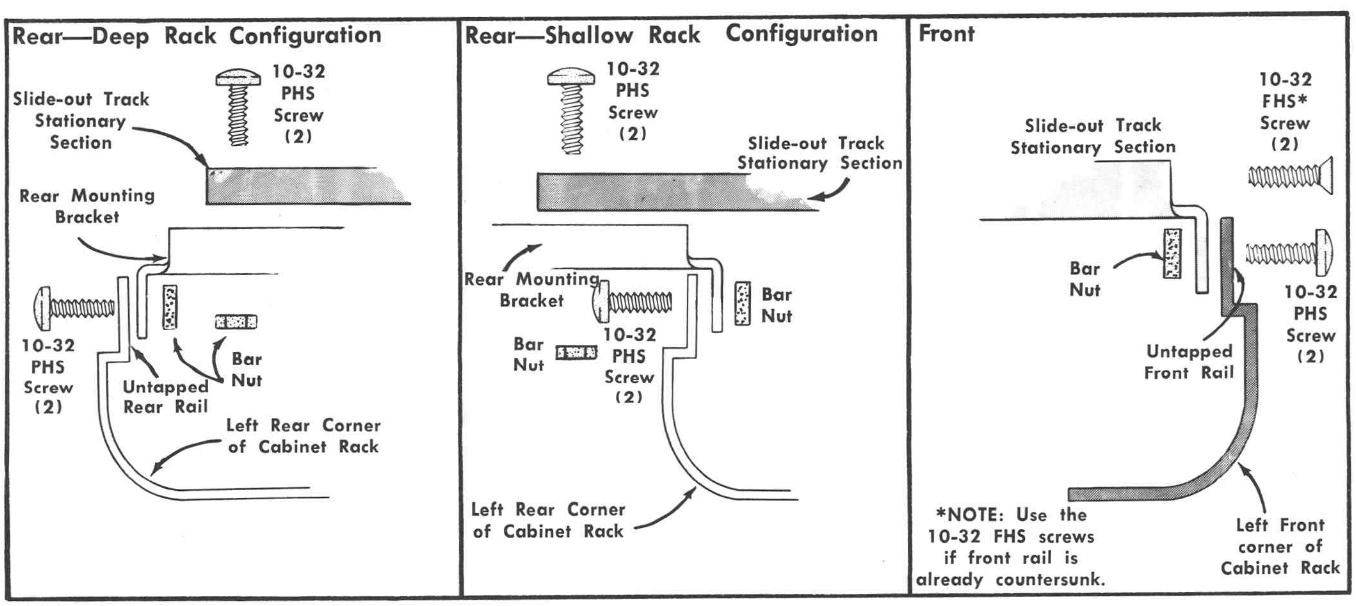


Fig. 6-6. Top view of cabinet rack showing mounting position of the left stationary section to the rails of the rack. Since the rails are not tapped bar nuts are used to mount the stationary section to the rack rails.

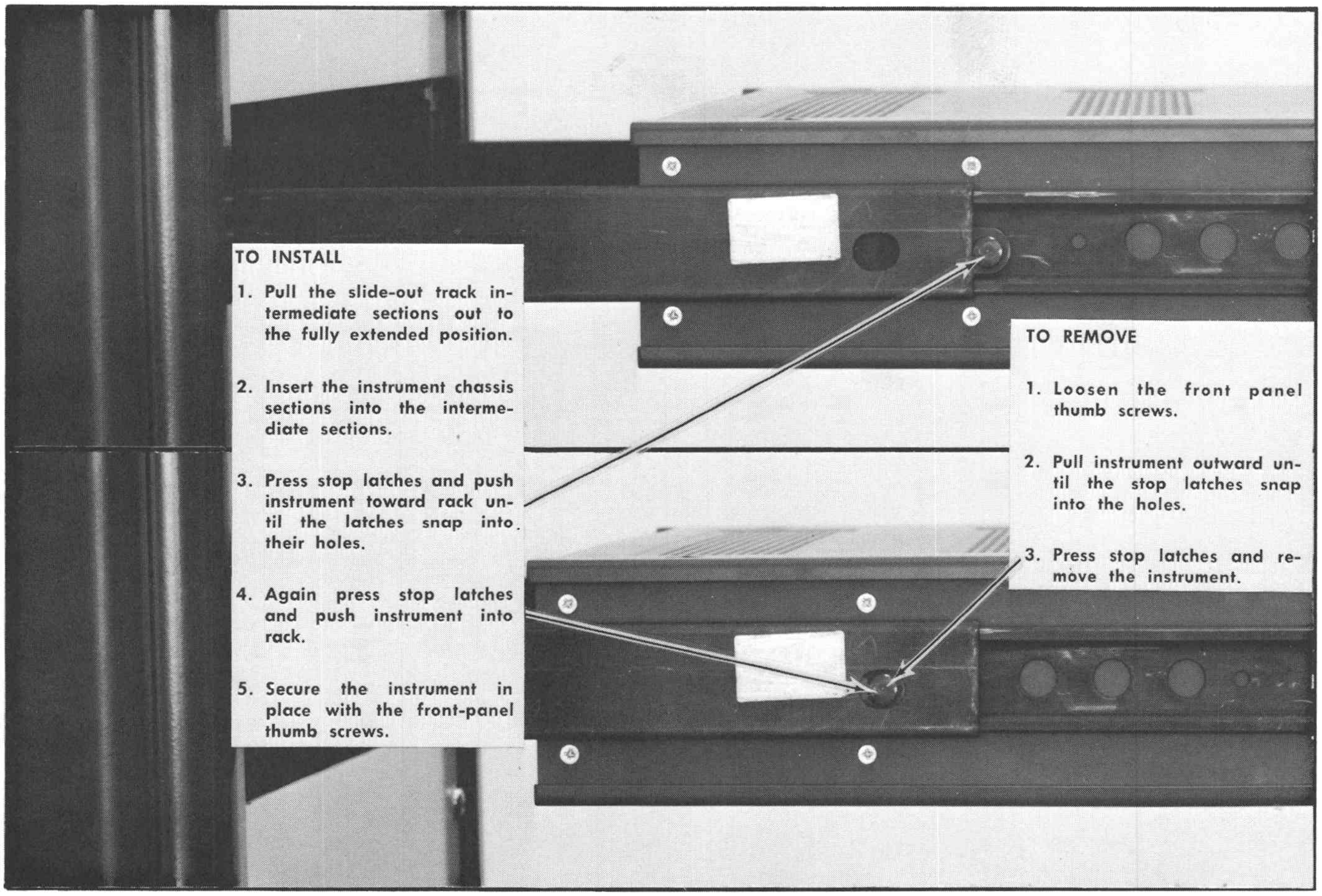


Fig. 6-7. Installing and removing the instrument.

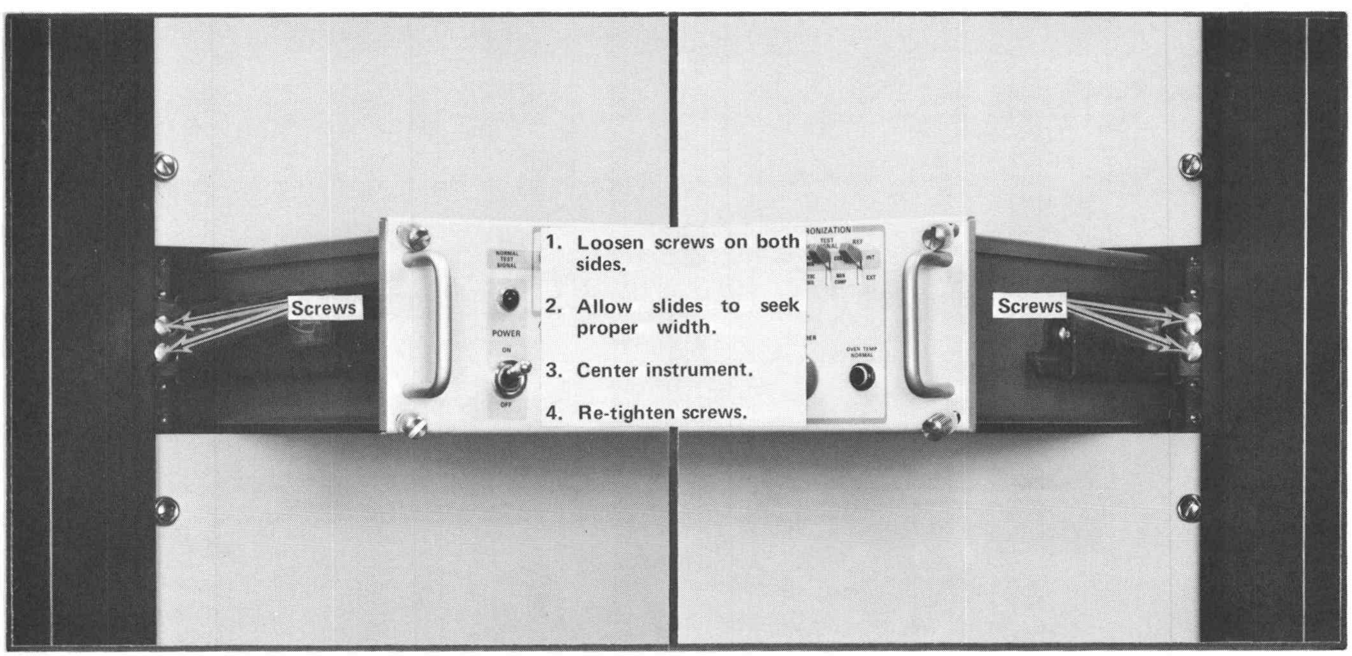
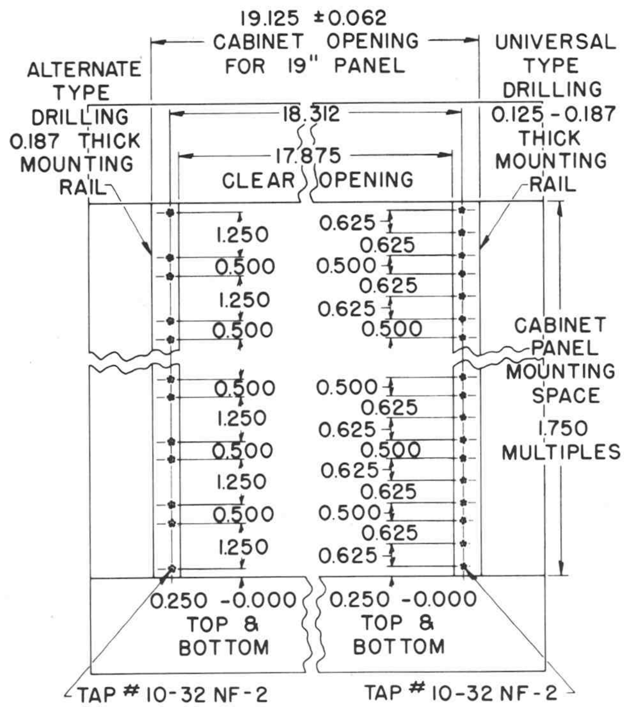
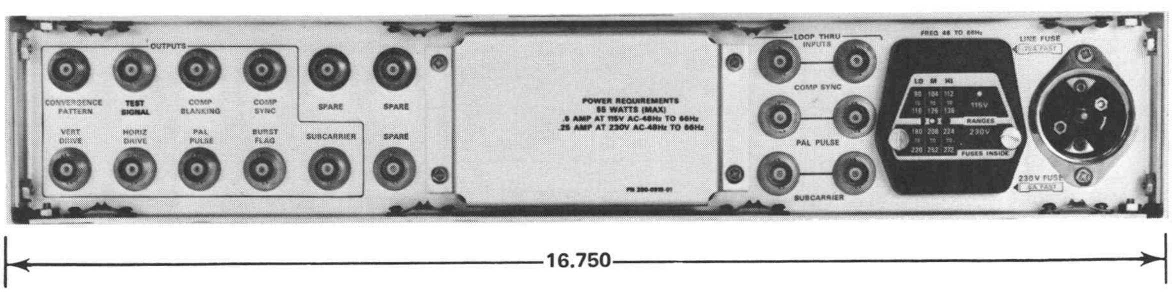
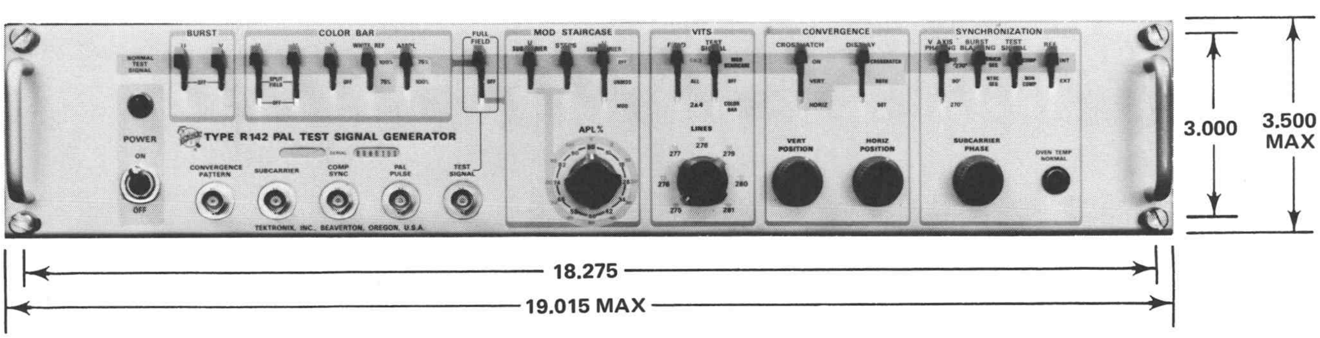


Fig. 6-8. Adjusting the slide-out tracks for smooth sliding action.

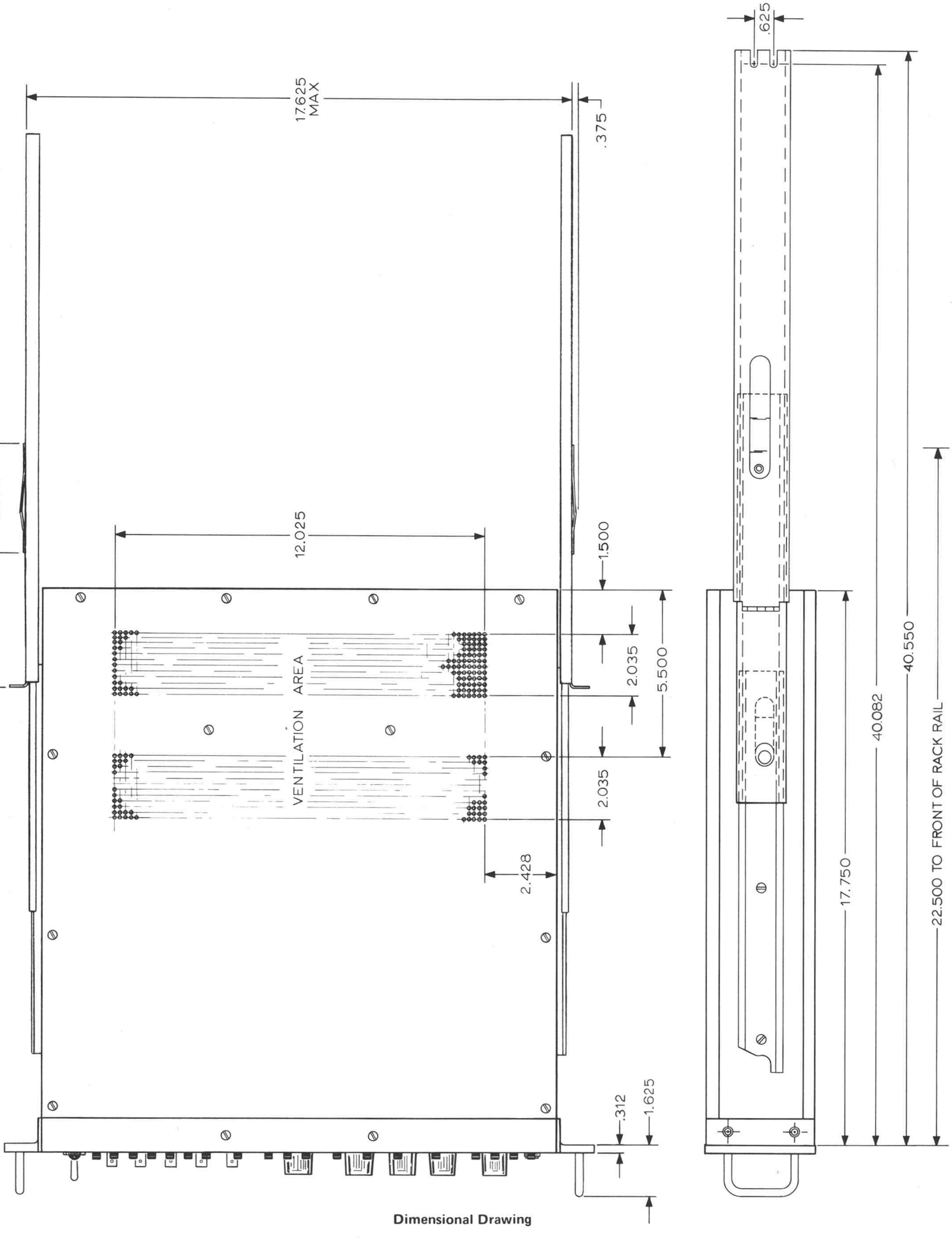
RACK RAIL TYPES







Dimensional Drawing



Dimensional Drawing

NOTES

PARTS LIST ABBREVIATIONS

BHB	binding head brass
BHS	binding head steel
cap.	capacitor
cer	ceramic
comp	composition
conn	connector
CRT	cathode-ray tube
csk	countersunk
DE	double end
dia	diameter
div	division
elect.	electrolytic
EMC	electrolytic, metal cased
EMT	electrolytic, metal tubular
ext	external
F & I	focus and intensity
FHB	flat head brass
FHS	flat head steel
Fil HB	fillister head brass
Fil HS	fillister head steel
h	height or high
hex.	hexagonal
HHB	hex head brass
HHS	hex head steel
HSB	hex socket brass
HSS	hex socket steel
ID	inside diameter
inc	incandescent
int	internal
lg	length or long
met.	metal
mtg hdw	mounting hardware
OD	outside diameter
OHB	oval head brass
OHS	oval head steel
P/O	part of
PHB	pan head brass
PHS	pan head steel
plstc	plastic
PMC	paper, metal cased
poly	polystyrene
prec	precision
PT	paper, tubular
PTM	paper or plastic, tubular, molded
RHB	round head brass
RHS	round head steel
SE	single end
SN or S/N	serial number
S or SW	switch
TC	temperature compensated
THB	truss head brass
thk	thick
THS	truss head steel
tub.	tubular
var	variable
w	wide or width
WW	wire-wound

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial or model number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

SPECIAL NOTES AND SYMBOLS

×000	Part first added at this serial number
00×	Part removed after this serial number
*000-0000-00	Asterisk preceding Tektronix Part Number indicates manufactured by or for Tektronix, Inc., or reworked or checked components.
Use 000-0000-00	Part number indicated is direct replacement.

INDEX OF ELECTRICAL PARTS LIST

Title	Page No.
CHASSIS	7-1
MODULATOR Circuit Board Assembly	7-4
BAR TIMING Circuit Board Assembly	7-8
FIELD TIMING Circuit Board Assembly	7-10
BAR DRIVE & VIDEO OUT Circuit Board Assembly	7-12
STAIRCASE Circuit Board Assembly	7-17
LINE TIMING Circuit Board Assembly	7-20
CROSSHATCH Circuit Board Assembly	7-25
OUTPUT AMP Circuit Board Assembly	7-29
SUBCARRIER OUTPUT Circuit Board Assembly	7-34
SUBCARRIER OSC Circuit Board Assembly	7-35
POWER SUPPLY Circuit Board Assembly	7-37
PAL LOCK Circuit Board Assembly	7-38

SECTION 7
ELECTRICAL PARTS LIST

Values are fixed unless marked Variable.

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description			

CHASSIS

Bulbs

DS42	150-0018-00			Incandescent, miniature 6.3 V			
DS88	150-0065-00			Incandescent, 10 V, 40 mA green lens			

Capacitors

Tolerance ±20% unless otherwise indicated.

C11	290-0334-00			1250 μF	Elect.	50 V	+75%—10%
C42	290-0321-00			11,000 μF	Elect.	15 V	+100%—10%
C61	290-0086-00			2000 μF	Elect.	30 V	
C92[1]							
C94[1]							
C98[1]							

Fuses

F2	159-0042-00			3/4 A	3AG Fast-Blo		
F3	159-0025-00			1/2 A	3AG Fast-Blo		

Filter

FL4	119-0095-04			2 x 1 A, 275 VAC, 400 Hz			

Connectors

J40	131-0126-00			BNC, single contact			
J42	131-0126-00			BNC, single contact			
J60	131-0126-00			BNC, single contact			
J62	131-0126-00			BNC, single contact			
J64	131-0126-00			BNC, single contact			
J66	131-0126-00			BNC, single contact			
J70	131-0126-00			BNC, single contact			
J72	131-0126-00			BNC, single contact			
J74	131-0126-00			BNC, single contact			
J76	131-0126-00			BNC, single contact			

[1]Furnished as a unit with Goniometer (*119-0133-00).

CHASSIS (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description			

Connectors

J80	131-0126-00			BNC, single contact			
J82	131-0126-00			BNC, single contact			
J84	131-0126-00			BNC, single contact			
J86	131-0126-00			BNC, single contact			
J88	131-0126-00			BNC, single contact			
J90	131-0126-00			BNC, single contact			
J92	131-0126-00			BNC, single contact			

Transistors

Q35	*151-0140-00			Silicon	NPN	TO-3 Selected from 2N3055	
Q55	*151-0140-00			Silicon	NPN	TO-3 Selected from 2N3055	
Q85	*151-0148-00			Silicon	NPN	Selected from 40250 RCA	
Q1131[2]							

Resistors

Resistors are fixed, composition, ±10% unless otherwise indicated.

R50	321-0329-00			26.1 kΩ	1/8 W	Prec	1%
R51	321-0283-00			8.66 kΩ	1/8 W	Prec	1%
R52	321-0254-00			4.32 kΩ	1/8 W	Prec	1%
R53	321-0233-00			2.61 kΩ	1/8 W	Prec	1%
R54	321-0216-00			1.74 kΩ	1/8 W	Prec	1%
R55	321-0202-00			1.24 kΩ	1/8 W	Prec	1%
R56	321-0190-00			931 Ω	1/8 W	Prec	1%
R57	321-0180-00			732 Ω	1/8 W	Prec	1%
R58	321-0170-00			576 Ω	1/8 W	Prec	1%
R60	311-0141-00			2 kΩ, Var			
R62	311-0141-00			2 kΩ, Var			
R64	315-0153-00			15 kΩ	1/4 W		5%
R66	315-0153-00			15 kΩ	1/4 W		5%
R94[3]							
R98[3]							
R1131[2]							
R1134[2]							
R1135[2]							
R1136[2]							
R1137[2]							

[2]Furnished as a unit with Partial Oven Assembly (*205-0108-01).

[3]Furnished as a unit with Goniometer (*119-0133-00).

CHASSIS (cont)

Switches

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description	
	Wired or Unwired				
S2[4]					
S3[4]					
S4	260-0276-00			Toggle	POWER
S10	260-0621-00			Lever	V AXIS PHASING
S12	260-0664-00			Lever	AMPL
S16	260-0621-00			Lever	FIELD
S18	260-1087-00			Rotary	LINE
S20A[5]					APL
S24	260-0621-00			Lever	SIGNAL
S26	260-0621-00			Lever	FULL FIELD
S30	260-0731-00			Lever	U BURST
S31	260-0731-00			Lever	BURST
S32	260-0731-00			Lever	U
S34	260-0731-00			Lever	V
S36	260-0731-00			Lever	Y
S38	260-0731-00			Lever	WHITE REF
S44	260-0621-00			Lever	V SUBCARRIER
S46	260-0731-00			Lever	U SUBCARRIER
S48	260-0664-00			Lever	STEPS
S50	260-0731-00			Lever	TEST SIGNAL SYNC
S52	260-0731-00			Lever	BURST BLANKING
S54	260-1088-00			Rotary	IRE LEVEL
S56	260-0731-00			Lever	REF
S62	260-0621-00			Lever	DISPLAY
S64	260-0621-00			Lever	CROSSHATCH
S1131[6]					

Transformers

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
T1	*120-0630-00			LV Power
T95[7]				

[4]See Mechanical Parts List. Line Voltage Selector Body.

[5]Furnished as a unit with S54.

[6]Furnished as a unit with Partial Oven Assembly (*205-0108-01).

[7]Furnished as a unit with Goniometer (*119-0133-00).

MODULATOR Circuit Board Assembly

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description			
	*670-0301-00			Complete Board			

Capacitors

Tolerance ±20% unless otherwise indicated.

Ckt. No.	Tektronix Part No.	Eff	Disc	Description			
C104	283-0004-00			0.02 μF	Cer	150 V	
C105	283-0047-00			270 pF	Cer	500 V	5%
C106	283-0047-00			270 pF	Cer	500 V	5%
C114	283-0004-00			0.02 μF	Cer	150 V	
C115	283-0047-00			270 pF	Cer	500 V	5%
C116	283-0047-00			270 pF	Cer	500 V	5%
C117	283-0047-00			270 pF	Cer	500 V	5%
C118	283-0047-00			270 pF	Cer	500 V	5%
C119	290-0134-00			22 μF	Elect.	15 V	
C120	290-0134-00			22 μF	Elect.	15 V	
C121	290-0134-00			22 μF	Elect.	15 V	
C124	283-0004-00			0.02 μF	Cer	150 V	
C125	283-0598-00			253 pF	Mica	300 V	5%
C127	283-0598-00			253 pF	Mica	300 V	5%
C128	283-0004-00			0.02 μF	Cer	150 V	
C129	290-0134-00			22 μF	Elect.	15 V	
C133	281-0116-00			1.6-9.1 pF, Var	Air		
C143	290-0134-00			22 μF	Elect.	15 V	
C152	281-0116-00			1.6-9.1 pF, Var	Air		
C157	281-0116-00			1.6-9.1 pF, Var	Air		
C162	283-0603-00			113 pF	Mica	300 V	2%
C167	283-0596-00			528 pF	Mica	300 V	1%
C168	283-0603-00			113 pF	Mica	300 V	2%
C173	283-0596-00			528 pF	Mica	300 V	1%
C176	283-0643-00			22 pF	Mica	300 V	±0.5 pF
C177	283-0004-00			0.02 μF	Cer	150 V	
C182	283-0603-00			113 pF	Mica	300 V	2%
C183	283-0004-00			0.02 μF	Cer	150 V	
C184	283-0638-00			130 pF	Mica	100 V	1%
C187	283-0596-00			528 pF	Mica	300 V	1%
C188	283-0603-00			113 pF	Mica	300 V	2%
C193	283-0596-00			528 pF	Mica	300 V	1%

MODULATOR Circuit Board Assembly (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description		
				Semiconductor Device, Diodes		
CR104	*152-0185-00			Silicon		Replaceable by 1N4152
CR105	*152-0185-00			Silicon		Replaceable by 1N4152
				Inductors		
L126	*114-0278-00			4.6-16.7 μH, Var		Core 276-0568-00
L163	*114-0280-00			12-43 μH, Var		Core 276-0568-00
L167	*114-0280-00			12-43 μH, Var		Core 276-0568-00
L176	*114-0281-00			35-70 μH, Var		Core 276-0540-00
L183	*114-0280-00			12-43 μH, Var		Core 276-0568-00
L184	*114-0281-00			35-70 μH, Var		Core 276-0540-00
L187	*114-0280-00			12-43 μH, Var		Core 276-0578-00
				Transistors		
Q111	151-0225-00			Silicon	NPN	TO-18 2N3563
Q112	151-0225-00			Silicon	NPN	TO-18 2N3563
Q113	151-0190-00			Silicon	NPN	TO-92 2N3904
Q114	151-0190-00			Silicon	NPN	TO-92 2N3904
Q115	151-0190-00			Silicon	NPN	TO-92 2N3904
Q116	151-0190-00			Silicon	NPN	TO-92 2N3904
Q117	151-0190-00			Silicon	NPN	TO-92 2N3904
Q118	151-0190-00			Silicon	NPN	TO-92 2N3904
Q122	151-0225-00			Silicon	NPN	TO-18 2N3563
Q123	151-0225-00			Silicon	NPN	TO-18 2N3563
Q145[8]	*153-0577-00			Silicon		Tek Spec
Q146[9]	*153-0577-00			Silicon		Tek Spec
Q153	151-0232-00			Silicon	NPN	TO-77 Dual
Q155	*153-0577-00			Silicon		Tek Spec
Q156	*153-0577-00			Silicon		Tek Spec
Q157	151-0232-00			Silicon	NPN	TO-77 Dual
Q165[10]	*153-0577-00			Silicon		Tek Spec
Q166[11]	*153-0577-00			Silicon		Tek Spec
Q172	*151-0195-00			Silicon	NPN	TO-92 Replaceable by MPS 6515
Q173	*151-0195-00			Silicon	NPN	TO-92 Replaceable by MPS 6515
Q175[12]	*153-0577-00			Silicon		Tek Spec
Q176[13]	*153-0577-00			Silicon		Tek Spec
Q177	*151-0195-00			Silicon	NPN	TO-92 Replaceable by MPS 6515
Q178	*151-0195-00			Silicon	NPN	TO-92 Replaceable by MPS 6515

[8] Q145, Q155, Q165 and Q175 furnished as a matched set.
[9] Q146, Q156, Q166 and Q176 furnished as a matched set.
[10] Q165, Q175, Q145 and Q155 furnished as a matched set.
[11] Q166, Q176, Q146 and Q156 furnished as a matched set.
[12] Q175, Q165, Q155 and Q145 furnished as a matched set.
[13] Q176, Q175, Q155 and Q145 furnished as a matched set.

MODULATOR Circuit Board Assembly (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description			

Resistors

Resistors are fixed, composition, ±10% unless otherwise indicated.

R100	315-0100-00			10 Ω	¼ W		5%
R101	315-0100-00			10 Ω	¼ W		5%
R102	315-0182-00			1.8 kΩ	¼ W		5%
R103	315-0102-00			1 kΩ	¼ W		5%
R104	315-0752-00			7.5 kΩ	¼ W		5%
R105	315-0103-00			10 kΩ	¼ W		5%
R106	315-0362-00			3.6 kΩ	¼ W		5%
R107	315-0302-00			3 kΩ	¼ W		5%
R108	315-0202-00			2 kΩ	¼ W		5%
R109	315-0100-00			10 Ω	¼ W		5%
R110	315-0100-00			10 Ω	¼ W		5%
R111	315-0152-00			1.5 kΩ	¼ W		5%
R112	315-0102-00			1 kΩ	¼ W		5%
R114	315-0272-00			2.7 kΩ	¼ W		5%
R115	315-0103-00			10 kΩ	¼ W		5%
R116	315-0362-00			3.6 kΩ	¼ W		5%
R117	315-0101-00			100 Ω	¼ W		5%
R118	301-0102-00			1 kΩ	½ W		5%
R119	315-0202-00			2 kΩ	¼ W		5%
R120	315-0100-00			10 Ω	¼ W		5%
R123	315-0102-00			1 kΩ	¼ W		5%
R124	315-0102-00			1 kΩ	¼ W		5%
R126	315-0102-00			1 kΩ	¼ W		5%
R127	315-0181-00			180 Ω	¼ W		5%
R128	321-0122-00			182 Ω	⅛ W	Prec	1%
R129	315-0101-00			100 Ω	¼ W		5%
R130	321-0159-00			442 Ω	⅛ W	Prec	1%
R131	321-0122-00			182 Ω	⅛ W	Prec	1%
R132	321-0154-00			392 Ω	⅛ W	Prec	1%
R133	321-0154-00			392 Ω	⅛ W	Prec	1%
R134	315-0302-00			3 kΩ	¼ W		5%
R135	315-0302-00			3 kΩ	¼ W		5%
R136	321-0154-00			392 Ω	⅛ W	Prec	1%
R137	321-0154-00			392 Ω	⅛ W	Prec	1%
R138	321-0159-00			442 Ω	⅛ W	Prec	1%
R141	321-0812-07			455 Ω	⅛ W	Prec	1/10%
R142	311-0886-00			50 Ω, Var			
R143	315-0202-00			2 kΩ	¼ W		5%
R144	321-0812-07			455 Ω	⅛ W	Prec	1/10%
R145	315-0181-00			180 Ω	¼ W		5%

MODULATOR Circuit Board Assembly (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description			
				Resistors (cont)			
R146	315-0181-00			180 Ω	¼ W		5%
R147	315-0202-00			2 kΩ	¼ W		5%
R148	311-0886-00			50 Ω, Var			
R151	321-0735-07			1.001 kΩ	⅛ W	Prec	1/10%
R152	321-0735-07			1.001 kΩ	⅛ W	Prec	1/10%
R155	315-0181-00			180 Ω	¼ W		5%
R156	315-0181-00			180 Ω	¼ W		5%
R157	321-0812-07			455 Ω	⅛ W	Prec	1/10%
R158	321-0735-07			1.001 kΩ	⅛ W	Prec	1/10%
R161	321-0335-00			30.1 kΩ	⅛ W	Prec	1%
R162	321-0143-00			301 Ω	⅛ W	Prec	1%
R165	315-0181-00			180 Ω	¼ W		5%
R166	315-0181-00			180 Ω	¼ W		5%
R167	321-0812-07			455 Ω	⅛ W	Prec	1/10%
R168	321-0735-07			1.001 kΩ	⅛ W	Prec	1/10%
R169	321-0143-00			301 Ω	⅛ W	Prec	1%
R174	321-0210-00			1.5 kΩ	⅛ W	Prec	1%
R175	315-0181-00			180 Ω	¼ W		5%
R176	315-0181-00			180 Ω	¼ W		5%
R177	315-0102-00			1 kΩ	¼ W		5%
R178	321-0335-00			30.1 kΩ	⅛ W	Prec	1%
R179	321-0335-00			30.1 kΩ	⅛ W	Prec	1%
R182	321-0143-00			301 Ω	⅛ W	Prec	1%
R183	321-0335-00			30.1 kΩ	⅛ W	Prec	1%
R186	315-0302-00			3 kΩ	¼ W		5%
R188	321-0143-00			301 Ω	⅛ W	Prec	1%
R193	315-0102-00			1 kΩ	¼ W		5%
R194	315-0302-00			3 kΩ	¼ W		5%
				Transformer			
T127	*120-0631-00			Toroid, 10-turns trifilar			
T136	*120-0584-00			Toroid, three 10-turn windings			
T144	*120-0587-00			Toroid, four 10-turn windings			
T174	*120-0524-00			Toroid, 12-turns quadfilar			
				Integrated Circuit			
U102	156-0012-00			Clocked J-K flip-flop Replaceable by Fairchild μL923			

BAR TIMING Circuit Board Assembly

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
	*670-0302-01			Complete Board

Capacitors

Tolerance ±20% unless otherwise indicated.

Ckt. No.	Tektronix Part No.	Eff	Disc	Description			
C209	290-0134-00			22 μF	Elect.	15 V	
C212	283-0080-00			0.022 μF	Cer	25 V	+80%—20%
C215	283-0047-00			270 pF	Cer	500 V	5%
C216	283-0026-00			0.2 μF	Cer	25 V	
C218	283-0641-00			180 pF	Mica	100 V	1%
C223	283-0026-00			0.2 μF	Cer	25 V	
C231	283-0026-00			0.2 μF	Cer	25 V	
C252	283-0598-00			253 pF	Mica	300 V	5%

Semiconductor Device, Diodes

Ckt. No.	Tektronix Part No.	Eff	Disc	Description	
CR202	*152-0185-00			Silicon	Replaceable by 1N4152
CR206	*152-0185-00			Silicon	Replaceable by 1N4152
CR261	*152-0185-00			Silicon	Replaceable by 1N4152

Inductor

Ckt. No.	Tektronix Part No.	Eff	Disc	Description	
L217	114-0177-00			280-650 μH, Var	Core 276-0506-00

Transistors

Ckt. No.	Tektronix Part No.	Eff	Disc	Description		
Q203	*151-0219-00			Silicon	PNP	TO-18 Replaceable by 2N4250
Q206	151-0224-00			Silicon	NPN	TO-18 2N3692
Q213	151-0190-00	B010100	B019999	Silicon	NPN	TO-92 2N3904
Q213	151-0224-00	B020000		Silicon	NPN	TO-18 2N3692
Q216	151-0220-00			Silicon	PNP	TO-18 2N4122
Q221	151-0220-00			Silicon	PNP	TO-18 2N4122
Q223	*151-0219-00			Silicon	PNP	TO-18 Replaceable by 2N4250
Q226	151-0225-00			Silicon	NPN	TO-18 2N3563
Q233	*151-0219-00			Silicon	PNP	TO-18 Replaceable by 2N4250
Q236	151-0220-00			Silicon	PNP	TO-18 2N4122
Q237	151-0225-00			Silicon	NPN	TO-18 2N3563
Q252	151-0224-00			Silicon	NPN	TO-18 2N3692
Q262	*151-0192-00			Silicon	NPN	TO-92 Replaceable by MPS 6521

BAR TIMING Circuit Board Assembly (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description			

Resistors

Resistors are fixed, composition, ±10% unless otherwise indicated.

Ckt. No.	Tektronix Part No.	Eff	Disc	Description			
R201	321-0126-00			200 Ω	1/8 W	Prec	1%
R202	321-0147-00			332 Ω	1/8 W	Prec	1%
R203	315-0470-00			47 Ω	1/4 W		5%
R204	315-0273-00			27 kΩ	1/4 W		5%
R205	315-0103-00			10 kΩ	1/4 W		5%
R206	315-0681-00			680 Ω	1/4 W		5%
R207	315-0470-00			47 Ω	1/4 W		5%
R213	321-0259-00			4.87 kΩ	1/8 W	Prec	1%
R214	321-0213-00			1.62 kΩ	1/8 W	Prec	1%
R215	321-0130-00			221 Ω	1/8 W	Prec	1%
R216	315-0202-00			2 kΩ	1/4 W		5%
R217	315-0470-00			47 Ω	1/4 W		5%
R218	315-0681-00			680 Ω	1/4 W		5%
R221	315-0102-00			1 kΩ	1/4 W		5%
R222	315-0163-00			16 kΩ	1/4 W		5%
R223	315-0473-00			47 kΩ	1/4 W		5%
R224	315-0102-00			1 kΩ	1/4 W		5%
R227	315-0681-00			680 Ω	1/4 W		5%
R232	311-0836-00			5 kΩ, Var			
R233	315-0102-00			1 kΩ	1/4 W		5%
R234	315-0471-00			470 Ω	1/4 W		5%
R235	311-0953-00			2.5 kΩ, Var			
R236	315-0102-00			1 kΩ	1/4 W		5%
R237	315-0132-00			1.3 kΩ	1/4 W		5%
R238	321-0193-00			1 kΩ	1/8 W	Prec	1%
R239	315-0102-00			1 kΩ	1/4 W		5%
R241	321-0346-00			39.2 kΩ	1/8 W	Prec	1%
R254	315-0102-00			1 kΩ	1/4 W		5%
R263	315-0101-00			100 Ω	1/4 W		5%

Integrated Circuits

Ckt. No.	Tektronix Part No.	Eff	Disc	Description
U243	156-0012-00			Clocked J-K flip-flop Replaceable by Fairchild μL923
U245	156-0012-00			Clocked J-K flip-flop Replaceable by Fairchild μL923
U247	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U248	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U253	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U255	156-0012-00			Clocked J-K flip-flop Replaceable by Fairchild μL923
U257	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U258	156-0012-00			Clocked J-K flip-flop Replaceable by Fairchild μL923
U265	156-0012-00			Clocked J-K flip-flop Replaceable by Fairchild μL923
U267	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914

BAR TIMING Circuit Board Assembly (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description

Integrated Circuits (cont)

U268	156-0012-00			Clocked J-K flip-flop Replaceable by Fairchild μL923
U275	156-0012-00			Clocked J-K flip-flop Replaceable by Fairchild μL923
U277	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U278	156-0012-00			Clocked J-K flip-flop Replaceable by Fairchild μL923
U298	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914

FIELD TIMING Circuit Board Assembly

*670-0303-01 Complete Board

Capacitors

Tolerance ±20% unless otherwise indicated.

C338	283-0032-00	470 pF	Cer	500 V	5%
C366	283-0032-00	470 pF	Cer	500 V	5%
C368	283-0104-00	2000 pF	Cer	500 V	5%
C372	283-0032-00	470 pF	Cer	500 V	5%

Transistors

Q311	151-0224-00	Silicon	NPN	TO-18 2N3692
Q312	151-0224-00	Silicon	NPN	TO-18 2N3692
Q314	151-0224-00	Silicon	NPN	TO-18 2N3692
Q316	151-0224-00	Silicon	NPN	TO-18 2N3692
Q317	151-0224-00	Silicon	NPN	TO-18 2N3692
Q318	151-0224-00	Silicon	NPN	TO-18 2N3692
Q319	151-0224-00	Silicon	NPN	TO-18 2N3692
Q333	151-0207-00	Silicon	NPN	TO-98 2N3415
Q381	151-0207-00	Silicon	NPN	TO-98 2N3415
Q384	151-0207-00	Silicon	NPN	TO-98 2N3415
Q385	151-0207-00	Silicon	NPN	TO-98 2N3415
Q388	151-0207-00	Silicon	NPN	TO-98 2N3415
Q394	151-0207-00	Silicon	NPN	TO-98 2N3415
Q397	151-0207-00	Silicon	NPN	TO-98 2N3415
Q398	151-0207-00	Silicon	NPN	TO-98 2N3415

Resistors

Resistors are fixed, composition, ±10% unless otherwise indicated.

R311	315-0102-00	1 kΩ	1/4 W	5%
R312	315-0102-00	1 kΩ	1/4 W	5%
R314	315-0102-00	1 kΩ	1/4 W	5%
R316	315-0102-00	1 kΩ	1/4 W	5%
R317	315-0102-00	1 kΩ	1/4 W	5%

FIELD TIMING Circuit Board Assembly (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description		
				Resistors (cont)		
R318	315-0102-00			1 kΩ	¼ W	5%
R319	315-0102-00			1 kΩ	¼ W	5%
R332	315-0182-00			1.8 kΩ	¼ W	5%
R333	315-0102-00			1 kΩ	¼ W	5%
R338	315-0272-00			2.7 kΩ	¼ W	5%
R339	315-0272-00			2.7 kΩ	¼ W	5%
R361	315-0561-00			560 Ω	¼ W	5%
R365	315-0243-00			24 kΩ	¼ W	5%
R366	315-0202-00			2 kΩ	¼ W	5%
R367	315-0272-00			2.7 kΩ	¼ W	5%
R368	315-0272-00			2.7 kΩ	¼ W	5%
R369	315-0272-00			2.7 kΩ	¼ W	5%
R372	315-0272-00			2.7 kΩ	¼ W	5%
R374	315-0272-00			2.7 kΩ	¼ W	5%
R392	315-0102-00			1 kΩ	¼ W	5%
R394	315-0102-00			1 kΩ	¼ W	5%
R396	315-0751-00			750 Ω	¼ W	5%
R397	315-0102-00			1 kΩ	¼ W	5%
R398	315-0152-00			1.5 kΩ	¼ W	5%
R399	315-0102-00			1 kΩ	¼ W	5%
				Integrated Circuits		
U301	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914		
U302	156-0012-00			Clocked J-K flip-flop Replaceable by Fairchild μL923		
U304	156-0012-00			Clocked J-K flip-flop Replaceable by Fairchild μL923		
U306	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914		
U308	156-0012-00			Clocked J-K flip-flop Replaceable by Fairchild μL923		
U309	156-0012-00			Clocked J-K flip-flop Replaceable by Fairchild μL923		
U321	156-0012-00			Clocked J-K flip-flop Replaceable by Fairchild μL923		
U322	156-0012-00			Clocked J-K flip-flop Replaceable by Fairchild μL923		
U324	156-0012-00			Clocked J-K flip-flop Replaceable by Fairchild μL923		
U326	156-0012-00			Clocked J-K flip-flop Replaceable by Fairchild μL923		
U328	156-0012-00			Clocked J-K flip-flop Replaceable by Fairchild μL923		
U329	156-0012-00			Clocked J-K flip-flop Replaceable by Fairchild μL923		
U334	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914		
U336	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914		
U338	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914		
U341	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914		
U342	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914		
U344	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914		
U346	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914		
U348	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914		

FIELD TIMING Circuit Board Assembly (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
				Integrated Circuits (cont)
U349	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U361	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U362	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U364	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U366	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U368	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U369	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U371	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U372	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U374	156-0012-00			Clocked J-K flip-flop Replaceable by Fairchild μL923
U376	156-0012-00			Clocked J-K flip-flop Replaceable by Fairchild μL923
U378	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U379	156-0012-00			Clocked J-K flip-flop Replaceable by Fairchild μL923
U396	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U399	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914

BAR DRIVE & VIDEO OUT Circuit Board Assembly

*670-0304-01 Complete Board

Capacitors

Tolerance ±20% unless otherwise indicated.

Ckt. No.	Tektronix Part No.	Value	Type	Voltage	Tolerance
C401	281-0650-00	18 pF	Cer	200 V	10%
C406	281-0613-00	10 pF	Cer	200 V	10%
C407	281-0613-00	10 pF	Cer	200 V	10%
C410	281-0616-00	6.8 pF	Cer	200 V	
C422	281-0022-00	8-50 pF, Var	Cer		
C427	281-0022-00	8-50 pF, Var	Cer		
C430	283-0080-00	0.022 μF	Cer	25 V	+80%—20%
C431	283-0080-00	0.022 μF	Cer	25 V	+80%—20%
C445	281-0650-00	18 pF	Cer	200 V	10%
C451	283-0596-00	528 pF	Mica	300 V	1%
C452	283-0051-00	0.0033 μF	Cer	100 V	5%
C455	283-0643-00	22 pF	Mica	300 V	±0.5 pF
C456	283-0602-00	53 pF	Mica	300 V	5%
C458	283-0594-00	0.001 μF	Mica	100 V	1%
C459	283-0634-00	65 pF	Mica	100 V	1%
C463	281-0616-00	6.8 pF	Cer	200 V	
C465	283-0636-00	36 pF	Mica	100 V	±0.5 pF
C467	283-0610-00	220 pF	Mica	500 V	5%
C468	283-0622-00	450 pF	Mica	300 V	1%
C469	283-0640-00	160 pF	Mica	100 V	1%

BAR DRIVE & VIDEO OUT Circuit Board Assembly (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description			
				Capacitors (cont)			
C471	283-0080-00			0.022 μF	Cer	25 V	+80%—20%
C478	283-0632-00			87 pF	Mica	100 V	1%
C479	283-0080-00			0.022 μF	Cer	25 V	+80%—20%
C484	283-0003-00			0.01 μF	Cer	150 V	
C487	283-0003-00			0.01 μF	Cer	150 V	
C489	283-0059-00			1 μF	Cer	25 V	+80%—20%
C491	283-0017-00			1 μF	Cer	3 V	
C492	283-0026-00			0.2 μF	Cer	25 V	
C493	283-0026-00			0.2 μF	Cer	25 V	
C495	290-0134-00			22 μF	Elect.	15 V	
C496	290-0134-00			22 μF	Elect.	15 V	
				Semiconductor Device, Diodes			
CR406	*152-0185-00			Silicon	Replaceable by 1N4152		
CR421	*152-0185-00			Silicon	Replaceable by 1N4152		
CR422	*152-0185-00			Silicon	Replaceable by 1N4152		
CR424	*152-0185-00			Silicon	Replaceable by 1N4152		
CR425	*152-0185-00			Silicon	Replaceable by 1N4152		
CR426	*152-0185-00			Silicon	Replaceable by 1N4152		
CR428	*152-0185-00			Silicon	Replaceable by 1N4152		
CR441	*152-0185-00			Silicon	Replaceable by 1N4152		
CR443	*152-0185-00			Silicon	Replaceable by 1N4152		
CR453	*152-0185-00			Silicon	Replaceable by 1N4152		
CR460	*152-0185-00			Silicon	Replaceable by 1N4152		
CR462	*152-0185-00			Silicon	Replaceable by 1N4152		
CR463	*152-0185-00			Silicon	Replaceable by 1N4152		
CR472	*152-0185-00			Silicon	Replaceable by 1N4152		
CR479	*152-0185-00			Silicon	Replaceable by 1N4152		
				Relay			
K495	*148-0034-00			Armature, dpdt, 15 V DC			
				Inductors			
L456	*114-0222-00			2-6 μH, Var	Core 276-0568-00		
L458	*114-0278-00			4.6-16.7 μH, Var	Core 276-0568-00		
L466	*114-0222-00			2-6 μH, Var	Core 276-0568-00		
L468	*114-0278-00			4.6-16.7 μH, Var	Core 276-0568-00		

BAR DRIVE & VIDEO OUT Circuit Board Assembly (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
				Transistors
Q400	*151-0192-00			Silicon NPN TO-92 Replaceable by MPS 6521
Q402	*151-0192-00			Silicon NPN TO-92 Replaceable by MPS 6521
Q403	*151-0192-00			Silicon NPN TO-92 Replaceable by MPS 6521
Q404	*151-0192-00			Silicon NPN TO-92 Replaceable by MPS 6521
Q406	*151-0192-00			Silicon NPN TO-92 Replaceable by MPS 6521
Q407	*151-0192-00			Silicon NPN TO-92 Replaceable by MPS 6521
Q408	*151-0192-00			Silicon NPN TO-92 Replaceable by MPS 6521
Q420	151-0224-00			Silicon NPN TO-18 2N3692
Q422	151-0224-00			Silicon NPN TO-18 2N3692
Q423	151-0224-00			Silicon NPN TO-18 2N3692
Q424	151-0224-00			Silicon NPN TO-18 2N3692
Q426	151-0224-00			Silicon NPN TO-18 2N3692
Q427	151-0224-00			Silicon NPN TO-18 2N3692
Q428	151-0224-00			Silicon NPN TO-18 2N3692
Q430	151-0220-00			Silicon PNP TO-18 2N4122
Q434	151-0224-00			Silicon NPN TO-18 2N3692
Q436	*151-0192-00			Silicon NPN TO-92 Replaceable by MPS 6521
Q437	151-0220-00			Silicon PNP TO-18 2N4122
Q441	*151-0192-00			Silicon NPN TO-92 Replaceable by MPS 6521
Q443	151-0224-00			Silicon NPN TO-18 2N3692
Q445	*151-0192-00			Silicon NPN TO-92 Replaceable by MPS 6521
Q446	*151-0192-00			Silicon NPN TO-92 Replaceable by MPS 6521
Q447	*151-0192-00			Silicon NPN TO-92 Replaceable by MPS 6521
Q450	*151-0192-00			Silicon NPN TO-92 Replaceable by MPS 6521
Q451	151-0224-00	B010100	B019999	Silicon NPN TO-18 2N3692
Q451	151-0207-00	B020000		Silicon NPN TO-98 2N3415
Q452	151-0224-00	B010100	B019999	Silicon NPN TO-18 2N3692
Q452	151-0225-00	B020000		Silicon NPN TO-18 2N3563
Q453	151-0224-00	B010100	B019999	Silicon NPN TO-18 2N3692
Q453	151-0225-00	B020000		Silicon NPN TO-18 2N3563
Q454	151-0224-00			Silicon NPN TO-18 2N3692
Q455	*151-0192-00			Silicon NPN TO-92 Replaceable by MPS 6521
Q456	*151-0192-00			Silicon NPN TO-92 Replaceable by MPS 6521
Q463	151-0224-00			Silicon NPN TO-18 2N3692
Q465	*151-0192-00			Silicon NPN TO-92 Replaceable by MPS 6521
Q471	*151-0219-00			Silicon PNP TO-18 Replaceable by 2N4250
Q473	*151-0192-00			Silicon NPN TO-92 Replaceable by MPS 6521
Q474	151-0220-00			Silicon PNP TO-18 2N4122
Q475	151-0220-00			Silicon PNP TO-18 2N4122
Q476	151-0220-00			Silicon PNP TO-18 2N4122

BAR DRIVE & VIDEO OUT Circuit Board Assembly (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description			
				Transistors (cont)			
Q477	151-0220-00			Silicon	PNP	TO-18 2N4122	
Q478	*151-0192-00			Silicon	NPN	TO-92 Replaceable by MPS 6521	
Q481	*151-0219-00			Silicon	PNP	Replaceable by 2N4250	
Q484	*151-0103-00			Silicon	NPN	TO-5 Replaceable by 2N2219	
Q487	*151-0103-00			Silicon	NPN	TO-5 Replaceable by 2N2219	
Q491	*151-0192-00			Silicon	NPN	TO-92 Replaceable by MPS 6521	
				Resistors			
Tolerance ±20% unless otherwise indicated.							
R400	321-0363-00			59 kΩ	⅛ W	Prec	1%
R401	321-0294-00			11.3 kΩ	⅛ W	Prec	1%
R402	315-0101-00			100 Ω	¼ W		5%
R403	315-0101-00			100 Ω	¼ W		5%
R404	321-0331-00			27.4 kΩ	⅛ W	Prec	1%
R406	321-0346-00			39.2 kΩ	⅛ W	Prec	1%
R407	321-0318-00			20 kΩ	⅛ W	Prec	1%
R408	315-0101-00			100 Ω	¼ W		5%
R409	315-0101-00			100 Ω	¼ W		5%
R410	311-0950-00			10 kΩ, Var			
R412	311-0732-00			1 kΩ, Var			
R413	311-0732-00			1 kΩ, Var			
R414	311-0840-00			20 kΩ, Var			
R416	311-0836-00			5 kΩ, Var			
R417	311-0953-00			2.5 kΩ, Var			
R418	321-0299-00			12.7 kΩ	⅛ W	Prec	1%
R419	311-0953-00			2.5 kΩ, Var			
R421	315-0102-00			1 kΩ	¼ W		5%
R422	321-0287-00			9.53 kΩ	⅛ W	Prec	1%
R423	315-0101-00			100 Ω	¼ W		5%
R424	315-0681-00			680 Ω	¼ W		5%
R427	316-0821-00			820 Ω	¼ W		5%
R428	315-0101-00			100 Ω	¼ W		5%
R430	315-0474-00			470 Ω	¼ W		5%
R431	315-0204-00			200 kΩ	¼ W		5%
R433	311-0704-00			500 Ω, Var			
R435	321-0260-00			4.99 kΩ	⅛ W	Prec	1%
R437	321-0294-00			11.3 kΩ	⅛ W	Prec	1%
R438	315-0101-00			100 Ω	¼ W		5%
R439	315-0752-00			7.5 kΩ	¼ W		5%
R441	321-0396-00			130 kΩ	⅛ W	Prec	1%
R442	315-0103-00			10 kΩ	¼ W		5%
R443	311-0953-00			2.5 kΩ, Var			
R445	321-0308-00			15.8 kΩ	⅛ W	Prec	1%
R446	321-0294-00			11.3 kΩ	⅛ W	Prec	1%

BAR DRIVE & VIDEO OUT Circuit Board Assembly (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description			
				Resistors (cont)			
R447	315-0101-00			100 Ω	¼ W		5%
R448	315-0102-00			1 kΩ	¼ W		5%
R449	315-0102-00			1 kΩ	¼ W		5%
R451	315-0102-00			1 kΩ	¼ W		5%
R452	315-0101-00			100 Ω	¼ W		5%
R453	311-0953-00			2.5 kΩ, Var			
R454	311-0732-00			1 kΩ, Var			
R455	321-0304-00			14.3 kΩ	⅛ W	Prec	1%
R456	315-0101-00			100 Ω	¼ W		5%
R457	321-0105-00	B010100	B019999	121 Ω	⅛ W	Prec	1%
R457	321-0108-00	B020000		130 Ω	⅛ W	Prec	1%
R458	321-0117-00			162 Ω	⅛ W	Prec	1%
R459	321-0172-00			604 Ω	⅛ W	Prec	1%
R460	315-0472-00			4.7 kΩ	¼ W		5%
R461	315-0273-00			27 kΩ	¼ W		5%
R462	315-0561-00			560 Ω	¼ W		5%
R463	311-0950-00			10 kΩ, Var			
R464	321-0349-00			42.2 kΩ	⅛ W	Prec	1%
R465	321-0280-00			8.06 kΩ	⅛ W	Prec	1%
R466	321-0210-00			1.5 kΩ	⅛ W	Prec	1%
R467	321-0181-00			750 Ω	⅛ W	Prec	1%
R468	321-0241-00			3.16 kΩ	⅛ W	Prec	1%
R469	321-0197-00			1.1 kΩ	⅛ W	Prec	1%
R470	315-0473-00			47 kΩ	¼ W		5%
R471	315-0393-00			39 kΩ	¼ W		5%
R472	315-0512-00			5.1 kΩ	¼ W		5%
R473	321-0222-00			2 kΩ	⅛ W	Prec	1%
R474	315-0431-00			430 Ω	¼ W		5%
R475	321-0210-00			1.5 kΩ	⅛ W	Prec	1%
R476	321-0210-00			1.5 kΩ	⅛ W	Prec	1%
R477	315-0431-00			430 Ω	¼ W		5%
R478	311-0827-00			250 Ω, Var			
R479	321-0228-00			2.32 kΩ	⅛ W	Prec	1%
R480	315-0181-00			180 Ω	¼ W		5%
R481	321-0193-00			1 kΩ	⅛ W	Prec	1%
R482	311-0704-00			500 Ω, Var			
R483	315-0302-00			3 kΩ	¼ W		5%
R484	321-0231-00			2.49 kΩ	⅛ W	Prec	1%
R485	321-0210-00			1.5 kΩ	⅛ W	Prec	1%
R486	321-0231-00			2.49 kΩ	⅛ W	Prec	1%

BAR DRIVE & VIDEO OUT Circuit Board Assembly (cont)

Resistors (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description			
R487	321-0085-00			75 Ω	⅛ W	Prec	1%
R488[14]	*312-0656-00			121 Ω	⅛ W	Prec	1/10%
R489	315-0302-00			3 kΩ	¼ W		5%
R490	315-0473-00			47 kΩ	¼ W		5%
R491	315-0393-00			39 kΩ	¼ W		5%
R492	321-0277-00			7.5 kΩ	⅛ W	Prec	1%
R493	308-0252-00			390 Ω	3 W	WW	5%
R494 } R495 }	*312-0657-00			200 Ω	⅛ W	Matched pair	
R496	321-0085-00			75 Ω	⅛ W	Prec	1%
R497[15]	*312-0656-00			121 Ω	⅛ W	Prec	1/10%
R498	308-0314-00			680 Ω	3 W	WW	5%
R499	311-0884-00			100 Ω, Var			

STAIRCASE Circuit Board Assembly

*670-0305-00 Complete Board

Capacitors

Tolerance ±20% unless otherwise indicated.

Ckt. No.	Tektronix Part No.	Eff	Disc	Description			
C506	283-0080-00			0.022 μF	Cer	25 V	+80%—20%
C547	283-0032-00			470 pF	Cer	500 V	5%
C568	290-0296-00			100 μF	Elect.	20 V	

Semiconductor Device, Diodes

Ckt. No.	Tektronix Part No.	Eff	Disc	Description	
CR511	*152-0185-00			Silicon	Replaceable by 1N4152
CR512	*152-0185-00			Silicon	Replaceable by 1N4152
CR513	*152-0185-00			Silicon	Replaceable by 1N4152
CR514	*152-0185-00			Silicon	Replaceable by 1N4152
CR521	*152-0185-00			Silicon	Replaceable by 1N4152
CR522	*152-0185-00			Silicon	Replaceable by 1N4152
CR523	*152-0185-00			Silicon	Replaceable by 1N4152
CR524	*152-0185-00			Silicon	Replaceable by 1N4152
CR533	*152-0185-00			Silicon	Replaceable by 1N4152
CR534	*152-0185-00			Silicon	Replaceable by 1N4152

[14]Furnished as a matched pair with R497.
[15]Furnished as a matched pair with R488.

STAIRCASE Circuit Board Assembly (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description		
				Semiconductor Device, Diodes (cont)		
CR542	*152-0185-00			Silicon		Replaceable by 1N4152
CR545	*152-0185-00			Silicon		Replaceable by 1N4152
CR548	*152-0185-00			Silicon		Replaceable by 1N4152
				Transistors		
Q501	151-0224-00			Silicon	NPN	TO-18 2N3692
Q502	151-0224-00			Silicon	NPN	TO-18 2N3692
Q503	151-0224-00			Silicon	NPN	TO-18 2N3692
Q511	*151-0192-00			Silicon	NPN	TO-92 Replaceable by MPS 6521
Q512	151-0224-00			Silicon	NPN	TO-18 2N3692
Q513	151-0224-00			Silicon	NPN	TO-18 2N3692
Q514	*151-0192-00			Silicon	NPN	TO-92 Replaceable by MPS 6521
Q515	151-0220-00			Silicon	PNP	TO-18 2N4122
Q516	151-0224-00			Silicon	NPN	TO-18 2N3692
Q522	*151-0192-00			Silicon	NPN	TO-92 Replaceable by MPS 6521
Q523	*151-0192-00			Silicon	NPN	TO-92 Replaceable by MPS 6521
Q524	*151-0192-00			Silicon	NPN	TO-92 Replaceable by MPS 6521
Q525	151-0224-00			Silicon	NPN	TO-18 2N3692
Q526	151-0224-00			Silicon	NPN	TO-18 2N3692
Q531	*151-0192-00			Silicon	NPN	TO-92 Replaceable by MPS 6521
Q532	*151-0192-00			Silicon	NPN	TO-92 Replaceable by MPS 6521
Q533	*151-0192-00			Silicon	NPN	TO-92 Replaceable by MPS 6521
Q534	*151-0192-00			Silicon	NPN	TO-92 Replaceable by MPS 6521
Q535	151-0224-00			Silicon	NPN	TO-18 2N3692
Q536	151-0224-00			Silicon	NPN	TO-18 2N3692
Q542	151-0224-00			Silicon	NPN	TO-18 2N3692
Q543	*151-0192-00			Silicon	NPN	TO-92 Replaceable by MPS 6521
Q544	*151-0192-00			Silicon	NPN	TO-92 Replaceable by MPS 6521
Q545	151-0224-00			Silicon	NPN	TO-18 2N3692
Q546	151-0225-00			Silicon	NPN	TO-18 2N3563

Resistors

Resistors are fixed, composition, ±10% unless otherwise indicated.

Ckt. No.	Tektronix Part No.	Eff	Disc	Description			
R501	321-0431-00			301 kΩ	⅛ W	Prec	1%
R502	321-0335-00			30.1 kΩ	⅛ W	Prec	1%
R504	321-0339-00			33.2 kΩ	⅛ W	Prec	1%
R505	315-0102-00			1 kΩ	¼ W		5%
R512	315-0103-00			10 kΩ	¼ W		5%

STAIRCASE Circuit Board Assembly (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description			
				Resistors (cont)			
R514	315-0101-00			100 Ω	¼ W		5%
R515	315-0101-00			100 Ω	¼ W		5%
R521	315-0333-00			33 kΩ	¼ W		5%
R522	315-0152-00			1.5 kΩ	¼ W		5%
R523	315-0471-00			470 Ω	¼ W		5%
R524	315-0101-00			100 Ω	¼ W		5%
R525	315-0101-00			100 Ω	¼ W		5%
R531	315-0101-00			100 Ω	¼ W		5%
R532	315-0101-00			100 Ω	¼ W		5%
R533	315-0101-00			100 Ω	¼ W		5%
R534	315-0101-00			100 Ω	¼ W		5%
R535	315-0101-00			100 Ω	¼ W		5%
R541	315-0101-00			100 Ω	¼ W		5%
R542	315-0362-00			3.6 kΩ	¼ W		5%
R543	315-0681-00			680 Ω	¼ W		5%
R544	315-0101-00			100 Ω	¼ W		5%
R545	321-0262-01			5.23 kΩ	⅛ W	Prec	½%
R547	315-0272-00			2.7 kΩ	¼ W		5%
R548	315-0202-00			2 kΩ	¼ W		5%
R549	315-0152-00			1.5 kΩ	¼ W		5%
R551	321-0334-00			29.4 kΩ	⅛ W	Prec	1%
R552	321-0327-00			24.9 kΩ	⅛ W	Prec	1%
R553	321-0327-00			24.9 kΩ	⅛ W	Prec	1%
R554	321-0327-00			24.9 kΩ	⅛ W	Prec	1%
R555	321-0327-00			24.9 kΩ	⅛ W	Prec	1%
R556	321-0327-00			24.9 kΩ	⅛ W	Prec	1%
R557	321-0295-00			11.5 kΩ	⅛ W	Prec	1%
R561	311-0883-00			50 kΩ, Var			
R562	311-0953-00			2.5 kΩ, Var			
R593	311-0953-00			2.5 kΩ, Var			
R564	311-0953-00			2.5 kΩ, Var			
R565	311-0953-00			2.5 kΩ, Var			
R566	311-0953-00			2.5 kΩ, Var			
R567	311-0953-00			2.5 kΩ, Var			
				Integrated Circuits			
U507	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914			
U508	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914			
U509	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914			
U517	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914			
U518	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914			

STAIRCASE Circuit Board Assembly (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
				Integrated Circuits (cont)
U519	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U537	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U538	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U539	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U547	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U548	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914

LINE TIMING Circuit Board Assembly

*670-0306-00 Complete Board

Capacitors

Tolerance ±20% unless otherwise indicated.

Ckt. No.	Tektronix Part No.	Eff	Disc	Value	Type	Voltage	Tolerance
C603	283-0032-00			470 pF	Cer	500 V	5%
C606	283-0032-00			470 pF	Cer	500 V	5%
C612	283-0032-00			470 pF	Cer	500 V	5%
C620	283-0149-00			25 pF	Cer	200 V	2%
C621	283-0004-00			0.02 μF	Cer	150 V	
C622	283-0004-00	B010100	B019999	0.02 μF	Cer	150 V	
C622	283-0059-00	B020000		1 μF	Cer	25 V	+80%—20%
C631	283-0594-00			0.001 μF	Mica	100 V	1%
C641	283-0077-00			330 pF	Cer	500 V	5%
C643	283-0032-00			470 pF	Cer	500 V	5%
C644	283-0617-00			4700 pF	Mica	300 V	10%
C647	283-0004-00			0.02 μF	Cer	150 V	
C648	283-0627-00			0.0033 μF	Mica	500 V	5%
C649	283-0065-00			0.001 μF	Cer	100 V	5%
C651	283-0077-00			330 pF	Cer	500 V	5%
C653	283-0032-00			470 pF	Cer	500 V	5%
C654	283-0639-00			56 pF	Mica	100 V	1%
C655	283-0594-00			0.001 μF	Mica	100 V	1%
C661	283-0077-00			330 pF	Cer	500 V	1%
C663	283-0004-00			0.02 μF	Cer	150 V	
C665	283-0594-00			0.001 μF	Mica	100 V	1%
C666	290-0246-00			3.3 μF	Elect.	15 V	10%
C669	283-0622-00			450 pF	Mica	300 V	1%
C671	283-0077-00			330 pF	Cer	500 V	5%
C674	283-0004-00			0.02 μF	Cer	150 V	

LINE TIMING Circuit Board Assembly (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description			
				Capacitors (cont)			
C675	283-0004-00			0.02 μF	Cer	150 V	
C676	283-0004-00			0.02 μF	Cer	150 V	
C678	283-0004-00			0.02 μF	Cer	150 V	
C679	283-0004-00			0.02 μF	Cer	150 V	
C681	283-0077-00			330 pF	Cer	500 V	5%
C687	283-0004-00			0.02 μF	Cer	150 V	
C688	283-0003-00			0.01 μF	Cer	150 V	
C691	283-0077-00			330 pF	Cer	150 V	5%
C695	283-0004-00			0.02 μF	Cer	150 V	
C698	283-0004-00			0.02 μF	Cer	150 V	
C699	283-0004-00			0.02 μF	Cer	150 V	
				Semiconductor Device, Diodes			
CR621	*152-0185-00			Silicon		Replaceable by 1N4152	
CR622	*152-0185-00			Silicon		Replaceable by 1N4152	
CR648	152-0246-00			Silicon		Low leakage, 250 mW, 40 V	
CR653	*152-0269-00			Silicon		Voltage var cap. Tek Spec	
CR654	*152-0185-00			Silicon		Replaceable by 1N4152	
CR655	152-0008-00			Germanium			
CR658	*152-0185-00			Silicon		Replaceable by 1N4152	
CR664	*152-0185-00			Silicon		Replaceable by 1N4152	
CR675	*152-0185-00			Silicon		Replaceable by 1N4152	
CR676	*152-0185-00			Silicon		Replaceable by 1N4152	
CR677	*152-0185-00			Silicon		Replaceable by 1N4152	
CR685	*152-0185-00			Silicon		Replaceable by 1N4152	
CR697	*152-0185-00			Silicon		Replaceable by 1N4152	
				Transistors			
Q610	151-0225-00			Silicon	NPN	TO-18 2N3563	
Q521	151-0224-00			Silicon	NPN	TO-18 2N3692	
Q622	151-0224-00			Silicon	NPN	TO-18 2N3692	
Q642	151-0224-00			Silicon	NPN	TO-18 2N3692	
Q643	151-0220-00			Silicon	PNP	TO-18 2N4122	
Q644	151-0220-00			Silicon	PNP	TO-18 2N4122	
Q645	151-0220-00			Silicon	PNP	TO-18 2N4122	
Q646	*151-0192-00			Silicon	NPN	TO-92 Replaceable by MPS 6521	
Q647	*151-0192-00			Silicon	NPN	TO-92 Replaceable by MPS 6521	
Q648	*151-0192-00			Silicon	NPN	TO-92 Replaceable by MPS 6521	
Q649	151-0224-00			Silicon	NPN	TO-18 2N3692	
Q652	151-0224-00			Silicon	NPN	TO-18 2N3692	
Q656	151-0220-00			Silicon	PNP	TO-18 2N4122	
Q662	151-0224-00			Silicon	NPN	TO-18 2N3692	
Q666	*151-0192-00			Silicon	NPN	TO-92 Replaceable by MPS 6521	

LINE TIMING Circuit Board Assembly (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description		

Transistors (cont)

Ckt. No.	Tektronix Part No.	Eff	Disc	Description		
Q667	*151-0192-00			Silicon	NPN	TO-92 Replaceable by MPS 6521
Q668	151-0219-00			Silicon	PNP	TO-18 Replaceable by 2N4250
Q669	151-0223-00			Silicon	NPN	TO-18 2N4275
Q672	151-0224-00			Silicon	NPN	TO-18 2N3692
Q673	151-1011-01			Silicon	FET	N channel, junction type, dual
Q674	151-0190-00			Silicon	NPN	TO-92 2N3904
Q675	*151-0192-00			Silicon	NPN	TO-92 Replaceable by MPS 6521
Q676	151-0220-00			Silicon	PNP	TO-18 2N4122
Q677	151-0220-00			Silicon	PNP	TO-18 2N4122
Q682	151-0224-00			Silicon	NPN	TO-18 2N3692
Q683	*151-0216-00			Silicon	PNP	TO-92 Replaceable by MOT MPS 6523
Q684	151-0219-00			Silicon	PNP	TO-18 Replaceable by 2N4250
Q686	151-0220-00			Silicon	PNP	TO-18 2N4122
Q687	151-0190-00			Silicon	NPN	TO-92 2N3904
Q688	151-0190-00			Silicon	NPN	TO-92 2N3904
Q691	151-0224-00			Silicon	NPN	TO-18 2N3692
Q692	151-0224-00			Silicon	NPN	TO-18 2N3692
Q693	151-0216-00			Silicon	PNP	TO-92 Replaceable by MOT MPS 6523
Q694	*151-0219-00			Silicon	PNP	TO-18 Replaceable by 2N4250
Q696	151-0220-00			Silicon	PNP	TO-18 2N4122

Resistors

Resistors are fixed, composition, ±10% unless otherwise indicated.

Ckt. No.	Tektronix Part No.	Eff	Disc	Description		
R641	311-0704-00			500 Ω, Var		
R651	311-0704-00			500 Ω, Var		
R661	311-0704-00			500 Ω, Var		
R671	311-0704-00			500 Ω, Var		
R681	311-0704-00			500 Ω, Var		
R691	311-0732-00			1 kΩ, Var		
R6000	315-0202-00			2 kΩ	1/4 W	5%
R6010	315-0222-00			2.2 kΩ	1/4 W	5%
R6020	315-0243-00			24 kΩ	1/4 W	5%
R6030	315-0202-00			2 kΩ	1/4 W	5%
R6040	315-0222-00			2.2 kΩ	1/4 W	5%
R6050	315-0202-00			2 kΩ	1/4 W	5%
R6100	315-0222-00			2.2 kΩ	1/4 W	5%
R6110	315-0103-00			10 kΩ	1/4 W	5%
R6120	315-0222-00			2.2 kΩ	1/4 W	5%
R6121	315-0222-00			2.2 kΩ	1/4 W	5%
R6130	315-0222-00			2.2 kΩ	1/4 W	5%
R6190	315-0222-00			2.2 kΩ	1/4 W	5%
R6210	315-0223-00			22 kΩ	1/4 W	5%
R6220	315-0222-00			2.2 kΩ	1/4 W	5%

LINE TIMING Circuit Board Assembly (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description			
				Resistors (cont)			
R6221	321-0316-00			19.1 kΩ	⅛ W	Prec	1%
R6230	315-0471-00			470 Ω	¼ W		5%
R6250	315-0100-00			10 Ω	¼ W		5%
R6260	315-0512-00			5.1 kΩ	¼ W		5%
R6330	315-0753-00			75 kΩ	¼ W		5%
R6331	315-0222-00			2.2 kΩ	¼ W		5%
R6350	315-0121-00			120 Ω	¼ W		5%
R6400	321-0252-00			4.12 kΩ	⅛ W	Prec	1%
R6420	321-0286-00	B010100	B019999	9.31 kΩ	⅛ W	Prec	1%
R6420	321-0284-00	B020000		8.87 kΩ	⅛ W	Prec	1%
R6430	315-0753-00			75 kΩ	¼ W		5%
R6440	315-0153-00			15 kΩ	¼ W		5%
R6450	315-0300-00			30 Ω	¼ W		5%
R6451	315-0561-00			560 Ω	¼ W		5%
R6460	315-0331-00			330 Ω	¼ W		5%
R6461	321-0366-00			63.4 kΩ	⅛ W	Prec	1%
R6470	315-0102-00			1 kΩ	¼ W		5%
R6471	317-0107-00			100 MΩ	⅛ W		5%
R6472	321-0377-00			82.5 kΩ	⅛ W	Prec	1%
R6480	315-0104-00			100 kΩ	¼ W		5%
R6481	315-0102-00			1 kΩ	¼ W		5%
R6490	315-0223-00			22 kΩ	¼ W		5%
R6491	315-0223-00			22 kΩ	¼ W		5%
R6500	321-0249-00			3.83 kΩ	⅛ W	Prec	1%
R6520	321-0295-00			11.5 kΩ	⅛ W	Prec	1%
R6540	321-0510-00			2 MΩ	⅛ W	Prec	1%
R6550	315-0105-00			1 MΩ	¼ W		5%
R6560	315-0103-00			10 kΩ	¼ W		5%
R6570	315-0103-00			10 kΩ	¼ W		5%
R6580	315-0220-00			22 Ω	¼ W		5%
R6581	315-0153-00			15 kΩ	¼ W		5%
R6590	315-0103-00			10 kΩ	¼ W		5%
R6600	321-0247-00			3.65 kΩ	⅛ W	Prec	1%
R6620	321-0298-00			12.4 kΩ	⅛ W	Prec	1%
R6630	315-0124-00			120 kΩ	¼ W		5%
R6631	315-0106-00			10 MΩ	¼ W		5%
R6640	321-0510-00			2 MΩ	⅛ W	Prec	1%
R6650	315-0124-00			120 kΩ	¼ W		5%
R6660	315-0274-00			270 kΩ	¼ W		5%
R6670	321-0281-00			8.25 kΩ	⅛ W	Prec	1%

LINE TIMING Circuit Board Assembly (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description			
				Resistors (cont)			
R6671	321-0270-00			6.34 kΩ	1/8 W	Prec	1%
R6700	321-0243-00			3.32 kΩ	1/8 W	Prec	1%
R6720	321-0314-00			18.2 kΩ	1/8 W	Prec	1%
R6730	315-0101-00			100 Ω	1/4 W		5%
R6731	315-0363-00			36 kΩ	1/4 W		5%
R6740	315-0152-00			1.5 kΩ	1/4 W		5%
R6741	321-0251-00			4.02 kΩ	1/8 W	Prec	1%
R6750	315-0331-00			330 Ω	1/4 W		5%
R6760	315-0472-00			4.7 kΩ	1/4 W		5%
R6761	315-0472-00			4.7 kΩ	1/4 W		5%
R6770	321-0260-00			4.99 kΩ	1/8 W	Prec	1%
R6771	315-0432-00			4.3 kΩ	1/4 W		5%
R6772	321-0251-00			4.02 kΩ	1/8 W	Prec	1%
R6780	321-0283-00			8.66 kΩ	1/8 W	Prec	1%
R6781	321-0302-00			13.7 kΩ	1/8 W	Prec	1%
R6782	315-0752-00			7.5 kΩ	1/4 W		5%
R6790	315-0202-00			2 kΩ	1/4 W		5%
R6791	315-0562-00			5.6 kΩ	1/4 W		5%
R6792	315-0103-00			10 kΩ	1/4 W		5%
R6800	321-0223-00			2.05 kΩ	1/8 W	Prec	1%
R6820	321-0312-00			17.4 kΩ	1/8 W	Prec	1%
R6830	315-0153-00			15 kΩ	1/4 W		5%
R6831	315-0682-00			6.8 kΩ	1/4 W		5%
R6840	315-0912-00			9.1 kΩ	1/4 W		5%
R6841	321-0260-00			4.99 kΩ	1/8 W	Prec	1%
R6850	315-0103-00			10 kΩ	1/4 W		5%
R6860	315-0472-00			4.7 kΩ	1/4 W		5%
R6870	315-0103-00			10 kΩ	1/4 W		5%
R6871	315-0332-00			3.3 kΩ	1/4 W		5%
R6880	315-0182-00			1.8 kΩ	1/4 W		5%
R6881	315-0100-00			10 Ω	1/4 W		5%
R6890	315-0470-00			47 Ω	1/4 W		5%
R6900	321-0235-00			2.74 kΩ	1/8 W	Prec	1%
R6920	321-0350-00			43.2 kΩ	1/8 W	Prec	1%
R6930	315-0363-00			36 kΩ	1/4 W		5%
R6931	315-0101-00			100 Ω	1/4 W		5%
R6932	315-0153-00			15 kΩ	1/4 W		5%
R6940	321-0260-00			4.99 kΩ	1/8 W	Prec	1%
R6950	315-0122-00			1.2 kΩ	1/4 W		5%
R6951	321-0260-00			4.99 kΩ	1/8 W	Prec	1%
R6960	315-0472-00			4.7 kΩ	1/4 W		5%
R6970	315-0103-00			10 kΩ	1/4 W		5%
R6980	315-0103-00			10 kΩ	1/4 W		5%
R6990	315-0470-00			47 Ω	1/4 W		5%

LINE TIMING Circuit Board Assembly (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
				Transformer
T655	*120-0564-00			Toroid, 3 windings
				Integrated Circuits
U601	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U602	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U603	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U605	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U606	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U607	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U609	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U612	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U613	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U615	156-0010-00			Buffer-inverter Replaceable by Fairchild μL900
U616	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U617	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U619	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U623	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U625	156-0012-00			Clocked J-K flip-flop Replaceable by Fairchild μL923
U626	156-0012-00			Clocked J-K flip-flop Replaceable by Fairchild μL923
U627	156-0012-00			Clocked J-K flip-flop Replaceable by Fairchild μL923
U629	156-0012-00			Clocked J-K flip-flop Replaceable by Fairchild μL923
U633	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U635	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U636	156-0012-00			Clocked J-K flip-flop Replaceable by Fairchild μL923
U637	156-0012-00			Clocked J-K flip-flop Replaceable by Fairchild μL923
U639	156-0012-00			Clocked J-K flip-flop Replaceable by Fairchild μL923
				Crystal
Y643	158-0039-00			1.006993 MHz

CROSSHATCH Circuit Board Assembly

	*670-0307-01	Complete Board

Capacitors

Tolerance ±20% unless otherwise indicated.

Ckt. No.	Tektronix Part No.	Value	Type	Voltage	Tolerance
C702	283-0104-00	2000 pF	Cer	500 V	5%
C705	285-0703-00	0.1 μF	PTM	100 V	5%
C706	283-0083-00	0.0047 μF	Cer	500 V	5%
C712	283-0065-00	0.001 μF	Cer	100 V	5%
C716	283-0083-00	0.0047 μF	Cer	500 V	5%

CROSSHATCH Circuit Board Assembly (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description			

Capacitors (cont)

Ckt. No.	Tektronix Part No.	Eff	Disc	Description			
C717	290-0134-00			22 μF	Elect.	15 V	
C718	290-0134-00			22 μF	Elect.	15 V	
C726	283-0032-00			470 pF	Cer	500 V	5%
C727	283-0003-00			0.01 μF	Cer	150 V	
C749	283-0080-00			0.022 μF	Cer	25 V	+80%—20%
C752	283-0026-00			0.2 μF	Cer	25 V	
C759	283-0632-00			87 pF	Mica	100 V	1%
C761	283-0594-00			0.001 μF	Mica	100 V	1%
C764	283-0047-00			270 pF	Cer	500 V	5%
C767	283-0596-00			528 pF	Mica	300 V	1%
C768	283-0602-00			53 pF	Mica	300 V	5%
C777	283-0026-00			0.2 μF	Cer	25 V	
C779	283-0610-00			220 pF	Mica	500 V	
C782	290-0134-00			22 μF	Elect.	15 V	
C783	283-0026-00			0.2 μF	Cer	25 V	
C785	283-0644-00			150 pF	Mica	500 V	1%
C792	283-0641-00			180 pF	Mica	100 V	1%
C795	283-0644-00			150 pF	Mica	500 V	1%
C796	283-0026-00			0.2 μF	Cer	25 V	

Semiconductor Device, Diodes

Ckt. No.	Tektronix Part No.	Eff	Disc	Description	
CR703	152-0008-00			Germanium	
CR749	*152-0185-00			Silicon	Replaceable by 1N4152
CR762	*152-0185-00			Silicon	Replaceable by 1N4152
CR781	*152-0185-00			Silicon	Replaceable by 1N4152
CR784	*152-0185-00			Silicon	Replaceable by 1N4152
CR787	*152-0185-00			Silicon	Replaceable by 1N4152
CR791	*152-0185-00			Silicon	Replaceable by 1N4152
CR794	*152-0185-00			Silicon	Replaceable by 1N4152

Inductors

Ckt. No.	Tektronix Part No.	Eff	Disc	Description	
L768	*114-0222-00			2-6 μH, Var	Core 276-0568-00
L769	*114-0222-00			2-6 μH, Var	Core 276-0568-00
L791	114-0177-00			280-650 μH, Var	Core 276-0506-00

Transistors

Ckt. No.	Tektronix Part No.	Eff	Disc	Description		
Q704	*151-0219-00			Silicon	PNP	TO-18 Replaceable by 2N4250
Q705	*151-0219-00			Silicon	PNP	TO-18 Replaceable by 2N4250
Q714	151-0190-00			Silicon	NPN	TO-92 2N3904
Q715	151-0190-00			Silicon	NPN	TO-92 2N3904
Q728	151-0103-00			Silicon	NPN	TO-5 Replaceable by 2N2219

CROSSHATCH Circuit Board Assembly (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description			
				Transistors (cont)			
Q737	151-0220-00			Silicon	PNP	TO-18 2N4122	
Q738	*151-0219-00			Silicon	PNP	TO-18 Replaceable by 2N4250	
Q739	*151-0195-00			Silicon	NPN	TO-92 Replaceable by MPS 6515	
Q751	*151-0219-00			Silicon	PNP	TO-18 Replaceable by 2N4250	
Q752	*151-0219-00			Silicon	PNP	TO-18 Replaceable by 2N4250	
Q761	151-0190-00			Silicon	NPN	TO-92 2N3904	
Q762	151-0190-00			Silicon	NPN	TO-92 2N3904	
Q776	151-0190-00			Silicon	NPN	TO-92 2N3904	
Q777	*151-0219-00			Silicon	PNP	TO-18 Replaceable by 2N4250	
Q783	151-0224-00			Silicon	NPN	TO-18 2N3692	
Q784	151-0220-00			Silicon	PNP	TO-18 2N4122	
Q786	151-0221-00			Silicon	PNP	TO-18 2N4258	
Q787	*151-0195-00			Silicon	NPN	TO-92 Replaceable by MPS 6515	
Q788	*151-0195-00			Silicon	NPN	TO-92 Replaceable by MPS 6515	
Q789	*151-0195-00			Silicon	NPN	TO-92 Replaceable by MPS 6515	
Q793	151-0225-00			Silicon	NPN	TO-18 2N3563	
Q794	151-0220-00			Silicon	PNP	TO-18 2N4122	
Q796	151-0190-00			Silicon	NPN	TO-92 2N3904	
Q797	*151-0198-00			Silicon	NPN	TO-92 Replaceable by MPS 918	
Q798	151-0190-00			Silicon	NPN	TO-92 2N3904	
Q799	151-0190-00			Silicon	NPN	TO-92 2N3904	
				Resistors			
Resistors are fixed, composition, ±10% unless otherwise indicated.							
R702	315-0272-00			2.7 kΩ	¼ W		5%
R703	321-0122-00			182 Ω	⅛ W	Prec	1%
R704	321-0225-00			2.51 kΩ	⅛ W	Prec	1%
R705	321-0300-00			13 kΩ	⅛ W	Prec	1%
R706	315-0432-00			4.3 kΩ	¼ W		5%
R707	315-0101-00			100 Ω	¼ W		5%
R709	308-0252-00			390 Ω	3 W	WW	5%
R711	315-0272-00			2.7 kΩ	¼ W		5%
R713	315-0681-00			680 Ω	¼ W		5%
R714	315-0102-00			1 kΩ	¼ W		5%
R716	315-0562-00			5.6 kΩ	¼ W		5%
R718	321-0085-00			75 Ω	⅛ W	Prec	1%
R719	321-0085-00			75 Ω	⅛ W	Prec	1%
R726	315-0202-00			2 kΩ	¼ W		5%
R727	315-0431-00			430 Ω	¼ W		5%
R728	315-0302-00			3 kΩ	¼ W		5%
R729	311-0884-00			100 Ω, Var			
R736	315-0243-00			24 kΩ	¼ W		5%
R738	321-0229-00			2.37 kΩ	⅛ W	Prec	1%
R739	321-0179-00			715 Ω	⅛ W	Prec	1%

CROSSHATCH Circuit Board Assembly (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description			
				Resistors (cont)			
R744	315-0181-00			180 Ω	1/4 W		5%
R745	315-0162-00			1.6 kΩ	1/4 W		5%
R747	321-0210-00			1.5 kΩ	1/8 W	Prec	1%
R748	321-0147-00			332 Ω	1/8 W	Prec	1%
R749	321-0281-00			8.25 kΩ	1/8 W	Prec	1%
R751	321-0242-00			3.24 kΩ	1/8 W	Prec	1%
R752	321-0269-00			6.19 kΩ	1/8 W	Prec	1%
R753	315-0470-00			47 Ω	1/4 W		5%
R754	315-0222-00			2.2 kΩ	1/4 W		5%
R757	321-0210-00			1.5 kΩ	1/8 W	Prec	1%
R758	321-0256-00			4.53 kΩ	1/8 W	Prec	1%
R759	321-0105-00	B010100	B019999	121 Ω	1/8 W	Prec	1%
R759	321-0108-00	B020000		130 Ω	1/8 W	Prec	1%
R760	321-0196-00			1.07 kΩ	1/4 W	Prec	1%
R761	315-0562-00			5.6 kΩ	1/4 W		5%
R762	315-0102-00			1 kΩ	1/4 W		5%
R763	315-0273-00			27 kΩ	1/4 W		5%
R764	315-0470-00			47 Ω	1/4 W		5%
R765	321-0310-00			16.5 kΩ	1/8 W	Prec	1%
R766	315-0102-00			1 kΩ	1/4 W		5%
R768	315-0470-00			47 Ω	1/4 W		5%
R770	315-0102-00			1 kΩ	1/4 W		5%
R771	315-0432-00			4.3 kΩ	1/4 W		5%
R772	315-0102-00			1 kΩ	1/4 W		5%
R773	315-0470-00			47 Ω	1/4 W		5%
R774	315-0472-00			4.7 kΩ	1/4 W		5%
R775	321-0270-00			6.34 kΩ	1/8 W	Prec	1%
R776	315-0102-00			1 kΩ	1/4 W		5%
R777	315-0470-00			47 Ω	1/4 W		5%
R778	315-0470-00			47 Ω	1/4 W		5%
R783	315-0202-00			2 kΩ	1/4 W		5%
R784	315-0471-00			470 Ω	1/4 W		5%
R787	321-0284-00			8.87 kΩ	1/8 W	Prec	1%
R788	321-0391-00			115 kΩ	1/8 W	Prec	1%
R789	321-0316-00			19.1 kΩ	1/8 W	Prec	1%
R791	315-0681-00			680 Ω	1/4 W		5%
R792	315-0102-00			1 kΩ	1/4 W		5%
R793	315-0132-00			1.3 kΩ	1/4 W		5%
R794	315-0132-00			1.3 kΩ	1/4 W		5%
R795	315-0103-00			10 kΩ	1/4 W		5%
R796	315-0162-00			1.6 kΩ	1/4 W		5%
R797	315-0102-00			1 kΩ	1/4 W		5%

CROSSHATCH Circuit Board Assembly (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description

Integrated Circuits

U711	156-0012-00			Clocked J-K flip-flop Replaceable by Fairchild μL923
U712	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U721	156-0012-00			Clocked J-K flip-flop Replaceable by Fairchild μL923
U722	156-0012-00			Clocked J-K flip-flop Replaceable by Fairchild μL923
U723	156-0012-00			Clocked J-K flip-flop Replaceable by Fairchild μL923
U724	156-0012-00			Clocked J-K flip-flop Replaceable by Fairchild μL923
U725	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U731	156-0012-00			Clocked J-K flip-flop Replaceable by Fairchild μL923
U732	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U733	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U734	156-0012-00			Clocked J-K flip-flop Replaceable by Fairchild μL923
U735	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U741	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U742	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U743	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U744	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U745	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U775	156-0012-00			Clocked J-K flip-flop Replaceable by Fairchild μL923
U785	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914

OUTPUT AMP Circuit Board Assembly

*670-0308-00 Complete Board

Capacitors

Tolerance ±20% unless otherwise indicated.

C903	283-0596-00	528 pF	Mica	300 V	1%
C904	283-0602-00	53 pF	Mica	300 V	5%
C905	283-0632-00	87 pF	Mica	100 V	1%
C906	283-0610-00	220 pF	Mica	500 V	
C912	283-0004-00	0.02 μF	Cer	150 V	
C914	290-0415-00	5.6 μF	Elect.	35 V	10%
C916	283-0004-00	0.02 μF	Cer	150 V	
C923	283-0596-00	528 pF	Mica	300 V	1%
C924	283-0602-00	53 pF	Mica	300 V	5%
C925	283-0632-00	87 pF	Mica	100 V	1%
C926	283-0610-00	220 pF	Mica	500 V	
C932	283-0004-00	0.02 μF	Cer	150 V	
C934	290-0415-00	5.6 μF	Elect.	35 V	10%
C936	283-0004-00	0.02 μF	Cer	150 V	
C943	283-0596-00	528 pF	Mica	300 V	1%

OUTPUT AMP Circuit Board Assembly (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description			
				Capacitors (cont)			
C944	283-0602-00			53 pF	Mica	300 V	5%
C945	283-0632-00			87 pF	Mica	100 V	1%
C946	283-0610-00			220 pF	Cer	500 V	
C952	283-0004-00			0.02 μF	Cer	150 V	
C954	290-0415-00			5.6 μF	Elect.	35 V	10%
C956	283-0004-00			0.02 μF	Cer	150 V	
C963	283-0596-00			528 pF	Mica	300 V	1%
C964	283-0602-00			53 pF	Mica	300 V	5%
C965	283-0632-00			87 pF	Mica	100 V	1%
C966	283-0610-00			220 pF	Mica	500 V	
C972	283-0004-00			0.02 μF	Cer	150 V	
C974	290-0415-00			5.6 μF	Elect.	35 V	10%
C976	283-0004-00			0.02 μF	Cer	150 V	
C981	290-0296-00			100 μF	Elect.	20 V	
C982	290-0409-00			1000 μF	Elect.	25 V	+75%—10%
C983	283-0596-00			528 pF	Mica	300 V	1%
C984	283-0602-00			53 pF	Mica	300 V	5%
C985	283-0632-00			87 pF	Mica	100 V	1%
C986	283-0610-00			220 pF	Mica	500 V	
C989	290-0134-00			22 μF	Elect.	15 V	
C992	283-0004-00			0.02 μF	Cer	150 V	
C994	290-0415-00			5.6 μF	Elect.	35 V	10%
C996	283-0004-00			0.02 μF	Cer	150 V	
				Semiconductor Device, Diodes			
CR906	*152-0185-00			Silicon	Replaceable by 1N4152		
CR926	*152-0185-00			Silicon	Replaceable by 1N4152		
CR946	*152-0185-00			Silicon	Replaceable by 1N4152		
CR966	*152-0185-00			Silicon	Replaceable by 1N4152		
CR986	*152-0185-00			Silicon	Replaceable by 1N4152		
				Inductors			
L904	*114-0222-00			2-6 μH, Var	Core 276-0568-00		
L905	*114-0222-00			2-6 μH, Var	Core 276-0568-00		
L924	*114-0222-00			2-6 μH, Var	Core 276-0568-00		
L925	*114-0222-00			2-6 μH, Var	Core 276-0568-00		
L944	*114-0222-00			2-6 μH, Var	Core 276-0568-00		
L945	*114-0222-00			2-6 μH, Var	Core 276-0568-00		
L964	*114-0222-00			2-6 μH, Var	Core 276-0568-00		
L965	*114-0222-00			2-6 μH, Var	Core 276-0568-00		
L984	*114-0222-00			2-6 μH, Var	Core 276-0568-00		
L985	*114-0222-00			2-6 μH, Var	Core 276-0568-00		

OUTPUT AMP Circuit Board Assembly (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description		
				Transistors		
Q900	151-0220-00			Silicon	PNP	TO-18 2N4122
Q902	151-0220-00			Silicon	PNP	TO-18 2N4122
Q910	151-0220-00			Silicon	PNP	TO-18 2N4122
Q912	151-0221-00			Silicon	PNP	TO-18 2N4258
Q914	151-0190-00			Silicon	NPN	TO-92 2N3904
Q916	151-0164-00			Silicon	PNP	TO-5 2N3702
Q920	151-0220-00			Silicon	PNP	TO-18 2N4122
Q922	151-0220-00			Silicon	PNP	TO-18 2N4122
Q930	151-0220-00			Silicon	PNP	TO-18 2N4122
Q932	151-0221-00			Silicon	PNP	TO-18 2N4258
Q934	151-0190-00			Silicon	NPN	TO-92 2N3904
Q936	151-0164-00			Silicon	PNP	TO-5 2N3702
Q940	151-0220-00			Silicon	PNP	TO-18 2N4122
Q942	151-0220-00			Silicon	PNP	TO-18 2N4122
Q950	151-0220-00			Silicon	PNP	TO-18 2N4122
Q952	151-0221-00			Silicon	PNP	TO-18 2N4258
Q954	151-0190-00			Silicon	NPN	TO-92 2N3904
Q956	151-0164-00			Silicon	PNP	TO-5 2N3702
Q960	151-0220-00			Silicon	PNP	TO-18 2N4122
Q962	151-0220-00			Silicon	PNP	TO-18 2N4122
Q964	151-0190-00			Silicon	NPN	TO-92 2N3904
Q970	151-0220-00			Silicon	PNP	TO-18 2N4122
Q972	151-0221-00			Silicon	PNP	TO-18 2N4258
Q974	151-0190-00			Silicon	NPN	TO-92 2N3904
Q976	151-0164-00			Silicon	PNP	TO-5 2N3702
Q978	151-0164-00			Silicon	PNP	TO-5 2N3702
Q980	151-0220-00			Silicon	PNP	TO-18 2N4122
Q982	151-0220-00			Silicon	PNP	TO-18 2N4122
Q990	151-0220-00			Silicon	PNP	TO-18 2N4122
Q992	151-0221-00			Silicon	PNP	TO-18 2N4258
Q994	151-0190-00			Silicon	NPN	TO-92 2N3904
Q996	151-0164-00			Silicon	PNP	TO-5 2N3702
Q998	151-0164-00			Silicon	PNP	TO-5 2N3702

Resistors

Resistors are fixed, composition, ±10% unless otherwise indicated.

Ckt. No.	Tektronix Part No.	Eff	Disc	Value	Power	Type	Tolerance
R900	315-0220-00			22Ω	1/4 W		5%
R901	321-0222-00			2 kΩ	1/8 W	Prec	1%
R902	315-0101-00			100 Ω	1/4 W		5%
R905	321-0105-00	B010100	B019999	121 Ω	1/8 W	Prec	1%
R905	321-0108-00	B020000		130 Ω	1/8 W	Prec	1%

OUTPUT AMP Circuit Board Assembly (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description			
				Resistors (cont)			
R906	321-0260-00			4.99 kΩ	1/8 W	Prec	1%
R907	315-0103-00			10 kΩ	1/4 W		5%
R908	321-0275-00			7.15 kΩ	1/8 W	Prec	1%
R909	315-0202-00			2 kΩ	1/4 W		5%
R910	321-0222-00			2 kΩ	1/8 W	Prec	1%
R911	322-0085-00			75 Ω	1/4 W	Prec	1%
R912	315-0563-00			56 kΩ	1/4 W		5%
R913	315-0102-00			1 kΩ	1/4 W		5%
R914	315-0103-00			10 kΩ	1/4 W		5%
R916	315-0100-00			10 Ω	1/4 W		5%
R920	315-0220-00			22 Ω	1/4 W		5%
R921	321-0222-00			2 kΩ	1/8 W	Prec	1%
R922	315-0101-00			100 Ω	1/4 W		5%
R925	321-0105-00	B010100	B019999	121 Ω	1/8 W	Prec	1%
R925	321-0108-00	B020000		130 Ω	1/8 W	Prec	1%
R926	321-0260-00			4.99 kΩ	1/8 W	Prec	1%
R927	315-0103-00			10 kΩ	1/4 W		5%
R928	321-0275-00			7.15 kΩ	1/8 W	Prec	1%
R929	315-0202-00			2 kΩ	1/4 W		5%
R930	321-0222-00			2 kΩ	1/8 W	Prec	1%
R931	322-0085-00			75 Ω	1/4 W	Prec	1%
R932	315-0563-00			56 kΩ	1/4 W		5%
R933	315-0102-00			1 kΩ	1/4 W		5%
R934	315-0103-00			10 kΩ	1/4 W		5%
R936	315-0100-00			10 Ω	1/4 W		5%
R940	315-0220-00			22 Ω	1/4 W		5%
R941	321-0222-00			2 kΩ	1/8 W	Prec	1%
R942	315-0101-00			100 Ω	1/4 W		5%
R944	301-0430-00			43 Ω	1/2 W		5%
R945	321-0105-00	B010100	B019999	121 Ω	1/8 W	Prec	1%
R945	321-0108-00	B020000		130 Ω	1/8 W	Prec	1%
R946	321-0260-00			4.99 kΩ	1/8 W	Prec	1%
R947	315-0103-00			10 kΩ	1/4 W		5%
R948	321-0275-00			7.15 kΩ	1/8 W	Prec	1%
R949	315-0202-00			2 kΩ	1/4 W		5%
R950	321-0222-00			2 kΩ	1/8 W	Prec	1%
R951	322-0085-00			75 Ω	1/4 W	Prec	1%
R952	315-0563-00			56 kΩ	1/4 W		5%
R953	315-0102-00			1 kΩ	1/4 W		5%
R954	315-0103-00			10 kΩ	1/4 W		5%
R956	315-0100-00			10 Ω	1/4 W		5%
R960	315-0220-00			22 Ω	1/4 W		5%
R961	321-0222-00			2 kΩ	1/8 W	Prec	1%
R962	315-0101-00			100 Ω	1/4 W		5%
R964	321-0282-00			8.45 kΩ	1/8 W	Prec	1%

OUTPUT AMP Circuit Board Assembly (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description			
				Resistors (cont)			
R965	321-0105-00	B010100	B019999	121 Ω	⅛ W	Prec	1%
R965	321-0108-00	B020000		130 Ω	⅛ W	Prec	1%
R966	321-0260-00			4.99 kΩ	⅛ W	Prec	1%
R967	315-0103-00			10 kΩ	¼ W		5%
R968	321-0275-00			7.15 kΩ	⅛ W	Prec	1%
R969	315-0202-00			2 kΩ	¼ W		5%
R970	321-0222-00			2 kΩ	⅛ W	Prec	1%
R971	322-0085-00			75 Ω	¼ W	Prec	1%
R972	315-0563-00			56 kΩ	¼ W		5%
R973	315-0102-00			1 kΩ	¼ W		5%
R974	315-0103-00			10 kΩ	¼ W		5%
R975	307-0113-00			5.1 Ω	¼ W		5%
R976	315-0100-00			10 Ω	¼ W		5%
R977	307-0113-00			5.1 Ω	¼ W		5%
R978	322-0085-00			75 Ω	¼ W	Prec	1%
R979	315-0100-00			10 Ω	¼ W		5%
R980	315-0220-00			22 Ω	¼ W		5%
R981	321-0222-00			2 kΩ	⅛ W	Prec	1%
R982	315-0101-00			100 Ω	¼ W		5%
R983	321-0213-00			1.62 kΩ	⅛ W	Prec	1%
R984	315-0822-00			8.2 kΩ	¼ W		5%
R985	321-0105-00	B010100	B019999	121 Ω	⅛ W	Prec	1%
R985	321-0108-00	B020000		130 Ω	⅛ W	Prec	1%
R986	321-0260-00			4.99 kΩ	⅛ W	Prec	1%
R987	315-0103-00			10 kΩ	¼ W		5%
R988	321-0275-00			7.15 kΩ	⅛ W	Prec	1%
R989	315-0202-00			2 kΩ	¼ W		5%
R990	321-0222-00			2 kΩ	⅛ W	Prec	1%
R991	322-0085-00			75 Ω	¼ W	Prec	1%
R992	315-0563-00			56 kΩ	¼ W		5%
R993	315-0102-00			1 kΩ	¼ W		5%
R994	315-0103-00			10 kΩ	¼ W		5%
R995	307-0113-00			5.1 Ω	¼ W		5%
R996	315-0100-00			10 Ω	¼ W		5%
R997	307-0113-00			5.1 kΩ	¼ W		5%
R998	322-0085-00			75 Ω	¼ W	Prec	1%
R999	315-0100-00			10 Ω	¼ W		5%

SUBCARRIER OUTPUT Circuit Board Assembly

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
	*670-0309-00			Complete Board

Capacitors

Tolerance ±20% unless otherwise indicated.

Ckt. No.	Tektronix Part No.	Eff	Disc	Description			
C1149	283-0641-00			180 pF	Mica	100 V	1%
C1150	283-0080-00			0.022 μF	Cer	25 V	+80%—20%
C1152	283-0640-00			160 pF	Mica	100 V	
C1156	290-0134-00			22 μF	Elect.	15 V	
C1157	283-0080-00			0.022 μF	Cer	25 V	+80%—20%
C1158	290-0134-00			22 μF	Elect.	15 V	
C1165	283-0080-00			0.022 μF	Cer	25 V	+80%—20%
C1186	283-0080-00			0.022 μF	Cer	25 V	+80%—20%
C1190	283-0641-00			180 pF	Mica	100 V	1%
C1192	283-0641-00			180 pF	Mica	100 V	1%

Semiconductor Device, Diodes

Ckt. No.	Tektronix Part No.	Eff	Disc	Description	
CR1105	*152-0185-00			Silicon	Replaceable by 1N4152
CR1110	*152-0185-00			Silicon	Replaceable by 1N4152
CR1115	*152-0185-00			Silicon	Replaceable by 1N4152
CR1156	*152-0185-00			Silicon	Replaceable by 1N4152

Inductors

Ckt. No.	Tektronix Part No.	Eff	Disc	Description	
L1147	*114-0280-00			12-43 μH, Var	Core 276-0568-00
L1197	*114-0280-00			12-43 μH, Var	Core 276-0568-00

Transistors

Ckt. No.	Tektronix Part No.	Eff	Disc	Description		
Q1101	*151-0195-00			Silicon	NPN	TO-92 Replaceable by MPS 6515
Q1105	151-0225-00			Silicon	NPN	TO-18 2N3563
Q1106	151-0225-00			Silicon	NPN	TO-18 2N3563
Q1111	*151-0192-00			Silicon	NPN	TO-92 Replaceable by MPS 6521
Q1118	151-0224-00			Silicon	NPN	TO-18 2N3692
Q1138	151-0224-00			Silicon	NPN	TO-18 2N3692
Q1159	*151-0103-00			Silicon	NPN	TO-5 Replaceable by 2N2219
Q1168	151-0225-00			Silicon	NPN	TO-18 2N3563
Q1179	151-0225-00			Silicon	NPN	TO-18 2N3563

SUBCARRIER OUTPUT Circuit Board Assembly (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description			

Resistors

Resistors are fixed, composition, ±10% unless otherwise indicated.

Ckt. No.	Tektronix Part No.	Eff	Disc	Description			
R1104	315-0242-00			2.4 kΩ	1/4 W		5%
R1105	321-0332-00			28 kΩ	1/8 W	Prec	1%
R1107	315-0102-00			1 kΩ	1/4 W		5%
R1110	315-0303-00			30 kΩ	1/4 W		5%
R1111	322-0157-00			422 Ω	1/4 W	Prec	1%
R1112	315-0302-00			3 kΩ	1/4 W		5%
R1114	315-0272-00			2.7 kΩ	1/4 W		5%
R1116	315-0203-00			20 kΩ	1/4 W		5%
R1119	315-0102-00			1 kΩ	1/4 W		5%
R1120	315-0102-00			1 kΩ	1/4 W		5%
R1121	321-0312-00			17.4 kΩ	1/8 W	Prec	1%
R1130	315-0470-00			47 Ω	1/4 W		5%
R1146	315-0470-00			47 Ω	1/4 W		5%
R1149	315-0470-00			47 Ω	1/4 W		5%
R1156	308-0243-00			240 Ω	3 W	WW	5%
R1157	315-0101-00			100 Ω	1/4 W		5%
R1158	322-0085-00			75 Ω	1/4 W	Prec	1%
R1159	322-0085-00			75 Ω	1/4 W	Prec	1%
R1160	321-0251-00			4.02 kΩ	1/8 W	Prec	1%
R1162	321-0293-00			11 kΩ	1/8 W	Prec	1%
R1165	315-0182-00			1.8 kΩ	1/4 W		5%
R1170	321-0277-00			7.5 kΩ	1/8 W	Prec	1%
R1176	321-0235-00			2.74 kΩ	1/8 W	Prec	1%
R1178	315-0332-00			3.3 kΩ	1/4 W		5%
R1186	315-0470-00			47 Ω	1/4 W		5%
R1192	321-0235-00			2.74 kΩ	1/8 W	Prec	1%
R1194	Selected						
R1195	311-0836-00			5 kΩ, Var			
R1196	Selected						

SUBCARRIER OSC Circuit Board Assembly

*670-0310-01 Complete Board

Capacitors

Tolerance ±20% unless otherwise indicated.

Ckt. No.	Tektronix Part No.	Eff	Disc	Description			
C1122	283-0103-00			180 pF	Cer	500 V	5%
C1123	283-0103-00			180 pF	Cer	500 V	5%
C1124	281-0616-00			6.8 pF	Cer	200 V	
C1125	283-0028-00			0.0022 μF	Cer	50 V	
C1130	283-0080-00			0.022 μF	Cer	25 V	+80%—20%

SUBCARRIER OSC Circuit Board Assembly (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description			
				Capacitors (cont)			
C1131	283-0059-00			1 μF	Cer	25 V	+80%—20%
C1133	283-0178-00			0.1 μF	Cer	100 V	+80%—20%
				Semiconductor Device, Diode			
CR1122	*152-0269-00			Silicon		Voltage var cap. Tek Spec	
				Transistors			
Q1126	*151-0198-00			Silicon	NPN	TO-92 Replaceable by MPS 918	
Q1127	*151-0198-00			Silicon	NPN	TO-92 Replaceable by MPS 918	
Q1133	*151-0195-00			Silicon	NPN	TO-92 Replaceable by MPS 6515	
Q1135	151-0232-00			Silicon	NPN	TO-77 Dual	
				Resistors			
Resistors are fixed, composition, ±10% unless otherwise indicated.							
R1122	315-0124-00			120 kΩ	¼ W		5%
R1123	315-0124-00			120 kΩ	¼ W		5%
R1124	315-0753-00			75 kΩ	¼ W		5%
R1125	315-0363-00			36 kΩ	¼ W		5%
R1126	315-0153-00			15 kΩ	¼ W		5%
R1127	315-0121-00			120 Ω	¼ W		5%
R1128	315-0820-00			82 Ω	¼ W		5%
R1129	315-0102-00			1 kΩ	¼ W		5%
R1132	315-0271-00			270 Ω	¼ W		5%
R1133	315-0332-00			3.3 kΩ	¼ W		5%
R1138	321-0249-00			3.83 kΩ	⅛ W	Prec	1%
R1139	321-0237-00			2.87 kΩ	⅛ W	Prec	1%
				Crystal			
Y1126	158-0066-00			3.579545 MHz			

POWER SUPPLY Circuit Board Assembly

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
	*670-0324-00			Complete Board

Capacitors

Tolerance ±20% unless otherwise indicated.

Ckt. No.	Tektronix Part No.	Eff	Disc	Description			
C816	283-0000-00			0.001 μF	Cer	500 V	
C835	290-0162-00			22 μF	Elect.	35 V	
C850	283-0002-00			0.01 μF	Cer	500 V	
C855	290-0171-00			100 μF	Elect.	12 V	
C871	283-0026-00			0.2 μF	Cer	25 V	
C875	283-0000-00			0.001 μF	Cer	500 V	
C880	283-0010-00			0.05 μF	Cer	50 V	
C885	290-0312-00			47 μF	Elect.	35 V	10%

Semiconductor Device, Diodes

Ckt. No.	Tektronix Part No.	Eff	Disc	Description	
CR811	152-0066-00			Silicon	1N3194
CR812	152-0066-00			Silicon	1N3194
CR813	152-0066-00			Silicon	1N3194
CR814	152-0066-00			Silicon	1N3194
CR815	*152-0185-00			Silicon	Replaceable by 1N4152
CR841	152-0198-00			Silicon	MR1032A 200 V PIV
CR842	152-0198-00			Silicon	MR1032A 200 V PIV
CR861	152-0066-00			Silicon	1N3194
CR862	152-0066-00			Silicon	1N3194
VR870	152-0212-00			Zener	1N936 500 mV, 9 V, 5%, TC

Transistors

Ckt. No.	Tektronix Part No.	Eff	Disc	Description		
Q810	151-0224-00			Silicon	NPN	TO-18 2N3692
Q815	151-1005-00			Silicon	FET	N channel, junction type
Q825	*151-0192-00			Silicon	NPN	TO-92 Replaceable by MPS 6521
Q826	*151-0192-00			Silicon	NPN	TO-92 Replaceable by MPS 6521
Q830	*151-0183-00			Silicon	NPN	TO-5 Selected from 2N2192
Q840	151-0224-00			Silicon	NPN	TO-18 2N3692
Q845	*151-0192-00			Silicon	NPN	TO-92 Replaceable by MPS 6521
Q846	*151-0192-00			Silicon	NPN	TO-92 Replaceable by MPS 6521
Q850	*151-0183-00			Silicon	NPN	TO-5 Selected from 2N2192
Q860	151-0224-00			Silicon	NPN	TO-18 2N3692
Q875	*151-0192-00			Silicon	NPN	TO-92 Replaceable by MPS 6521
Q876	*151-0192-00			Silicon	NPN	TO-92 Replaceable by MPS 6521
Q880	*151-0183-00			Silicon	NPN	TO-5 Selected from 2N2192

POWER SUPPLY Circuit Board Assembly (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description			

Resistors

Resistors are fixed, composition, ±10% unless otherwise indicated.

R811	308-0245-00			0.6 Ω	2 W	WW	5%
R813	315-0101-00			100 Ω	1/4 W		5%
R816	315-0101-00			100 Ω	1/4 W		5%
R826	315-0222-00			2.2 kΩ	1/4 W		5%
R831	315-0222-00			2.2 kΩ	1/4 W		5%
R835	321-0219-00			1.87 kΩ	1/8 W	Prec	1%
R836	311-0827-00			250 Ω, Var			
R837	321-0237-00			2.87 kΩ	1/8 W	Prec	1%
R841	308-0244-00			0.3 Ω	2 W	WW	
R843	315-0101-00			100 Ω	1/4 W		5%
R846	315-0222-00			2.2 kΩ	1/4 W		5%
R848	315-0821-00			820 Ω	1/4 W		5%
R850	315-0390-00			39 Ω	1/4 W		5%
R852	315-0392-00			3.9 kΩ	1/4 W		5%
R855	321-0171-00			590 Ω	1/8 W	Prec	1%
R856	311-0827-00			250 Ω, Var			
R857	321-0237-00			2.87 kΩ	1/8 W	Prec	1%
R861	308-0245-00			0.6 Ω	2 W	WW	5%
R864	315-0101-00			100 Ω	1/4 W		5%
R870	321-0183-00			787 Ω	1/8 W	Prec	1%
R871	315-0471-00			470 Ω	1/4 W		5%
R872	315-0181-00			180 Ω	1/4 W		5%
R875	315-0122-00			1.2 kΩ	1/4 W		5%
R877	315-0621-00			620 Ω	1/4 W		5%
R879	315-0101-00			100 Ω	1/4 W		5%
R880	315-0150-00			15 Ω	1/4 W		5%
R885	321-0215-00			1.69 kΩ	1/8 W	Prec	1%
R886	311-0837-00			250 Ω, Var			
R887	321-0195-00			1.05 kΩ	1/8 W	Prec	1%
R889	315-0332-00			3.3 kΩ	1/4 W		5%

PAL LOCK Circuit Board Assembly

	*670-0326-00	Complete Board

Capacitors

Tolerance ±20% unless otherwise indicated.

C1201	290-0415-00			5.6 μF	Elect.	35 V	10%
C1202	283-0080-00			0.022 μF	Cer	25 V	+80%—20%
C1203	283-0000-00			0.001 μF	Cer	500 V	
C1219	283-0080-00			0.022 μF	Cer	25 V	+80%—20%
C1220	283-0004-00			0.02 μF	Cer	150 V	

PAL LOCK Circuit Board Assembly (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description			
				Capacitors (cont)			
C1223	283-0032-00			470 pF	Cer	500 V	5%
C1226	283-0032-00			470 pF	Cer	500 V	5%
C1228	283-0080-00			0.022 μF	Cer	25 V	+80%—20%
C1243	283-0596-00			528 pF	Mica	300 V	1%
C1244	283-0602-00			53 pF	Mica	300 V	5%
C1245	283-0632-00			87 pF	Mica	100 V	1%
C1246	283-0610-00			220 pF	Mica	500 V	
C1252	283-0004-00			0.02 μF	Cer	150 V	
C1254	290-0415-00			5.6 μF	Elect.	35 V	10%
C1256	283-0004-00			0.02 μF	Cer	150 V	
				Semiconductor Device, Diodes			
CR1206	*152-0185-00			Silicon		Replaceable by 1N4152	
CR1209	*152-0185-00			Silicon		Replaceable by 1N4152	
CR1246	*152-0185-00			Silicon		Replaceable by 1N4152	
				Inductors			
L1244	*114-0222-00			2-6 μH, Var		Core 276-0568-00	
L1245	*114-0222-00			2-6 μH, Var		Core 276-0568-00	
				Transistors			
Q1201	151-0188-00			Silicon	PNP	TO-92 2N3906	
Q1204	151-0190-00			Silicon	NPN	TO-92 2N3904	
Q1206	151-0188-00			Silicon	PNP	TO-92 2N3906	
Q1207	151-0225-00			Silicon	NPN	TO-18 2N3563	
Q1209	151-0188-00			Silicon	PNP	TO-92 2N3906	
Q1233	*151-0198-00			Silicon	NPN	TO-92 Replaceable by MPS 918	
Q1234	*151-0198-00			Silicon	NPN	TO-92 Replaceable by MPS 918	
Q1236	151-0190-00			Silicon	NPN	TO-92 2N3904	
Q1238	151-0220-00			Silicon	PNP	TO-18 2N4122	
Q1240	151-0220-00			Silicon	PNP	TO-18 2N4122	
Q1242	151-0220-00			Silicon	PNP	TO-18 2N4122	
Q1250	151-0220-00			Silicon	PNP	TO-18 2N4122	
Q1252	151-0221-00			Silicon	PNP	TO-18 2N4258	
Q1254	151-0190-00			Silicon	NPN	TO-92 2N3904	
Q1256	151-0164-00			Silicon	PNP	TO-5 2N3702	

PAL LOCK Circuit Board Assembly (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description			

Resistors

Resistors are fixed, composition, ±10% unless otherwise indicated.

Ckt. No.	Tektronix Part No.	Eff	Disc	Description			
R1201	315-0152-00			1.5 kΩ	1/4 W		5%
R1202	315-0102-00			1 kΩ	1/4 W		5%
R1204	315-0102-00			1 kΩ	1/4 W		5%
R1205	315-0102-00			1 kΩ	1/4 W		5%
R1206	315-0152-00			1.5 kΩ	1/4 W		5%
R1207	315-0471-00			470 Ω	1/4 W		5%
R1208	315-0471-00			470 Ω	1/4 W		5%
R1209	315-0681-00			680 Ω	1/4 W		5%
R1210	315-0102-00			1 kΩ	1/4 W		5%
R1213	315-0152-00			1.5 kΩ	1/4 W		5%
R1217	315-0103-00			10 kΩ	1/4 W		5%
R1218	315-0220-00			22 Ω	1/4 W		5%
R1219	315-0472-00			4.7 kΩ	1/4 W		5%
R1220	315-0104-00			100 kΩ	1/4 W		5%
R1222	315-0100-00			10 Ω	1/4 W		5%
R1223	315-0100-00			10 Ω	1/4 W		5%
R1224	315-0243-00			24 kΩ	1/4 W		5%
R1225	315-0202-00			2 kΩ	1/4 W		5%
R1226	315-0202-00			2 kΩ	1/4 W		5%
R1227	315-0243-00			24 kΩ	1/4 W		5%
R1228	315-0242-00			2.4 kΩ	1/4 W		5%
R1230	315-0152-00			1.5 kΩ	1/4 W		5%
R1233	315-0102-00			1 kΩ	1/4 W		5%
R1234	315-0152-00			1.5 kΩ	1/4 W		5%
R1235	321-0256-00			4.53 kΩ	1/8 W	Prec	1%
R1236	321-0164-00			499 Ω	1/8 W	Prec	1%
R1240	315-0220-00			22 Ω	1/4 W		5%
R1241	321-0222-00			2 kΩ	1/8 W	Prec	1%
R1242	315-0101-00			100 Ω	1/4 W		5%
R1245	321-0105-00	B010100	B019999	130 Ω	1/8 W	Prec	1%
R1245	321-0108-00	B020000		121 Ω	1/8 W	Prec	1%
R1246	321-0260-00			4.99 kΩ	1/8 W	Prec	1%
R1247	315-0103-00			10 kΩ	1/4 W		5%
R1248	321-0275-00			7.15 kΩ	1/8 W	Prec	1%
R1249	315-0202-00			2 kΩ	1/4 W		5%
R1250	321-0222-00			2 kΩ	1/8 W	Prec	1%
R1251	322-0085-00			75 Ω	1/4 W	Prec	1%
R1252	315-0563-00			56 kΩ	1/4 W		5%
R1253	315-0102-00			1 kΩ	1/4 W		5%
R1254	315-0103-00			10 kΩ	1/4 W		5%
R1256	315-0100-00			10 Ω	1/4 W		5%

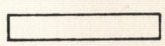
PAL LOCK Circuit Board Assembly (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
				Integrated Circuits
U1211	156-0012-00			Clocked J-K flip-flop Replaceable by Fairchild μL923
U1213	156-0012-00			Clocked J-K flip-flop Replaceable by Fairchild μL923
U1214	156-0012-00			Clocked J-K flip-flop Replaceable by Fairchild μL923
U1216	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U1217	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U1219	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U1221	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U1223	156-0012-00			Clocked J-K flip-flop Replaceable by Fairchild μL923
U1224	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U1226	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U1227	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914
U1229	156-0011-00			Medium power, dual 2 input gate Replaceable by Fairchild μL914

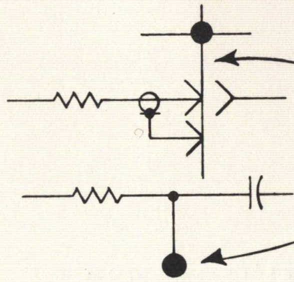
SECTION 8
DIAGRAMS
and
MECHANICAL PARTS ILLUSTRATIONS

The following special symbols are used on the diagrams:


Screwdriver adjustment

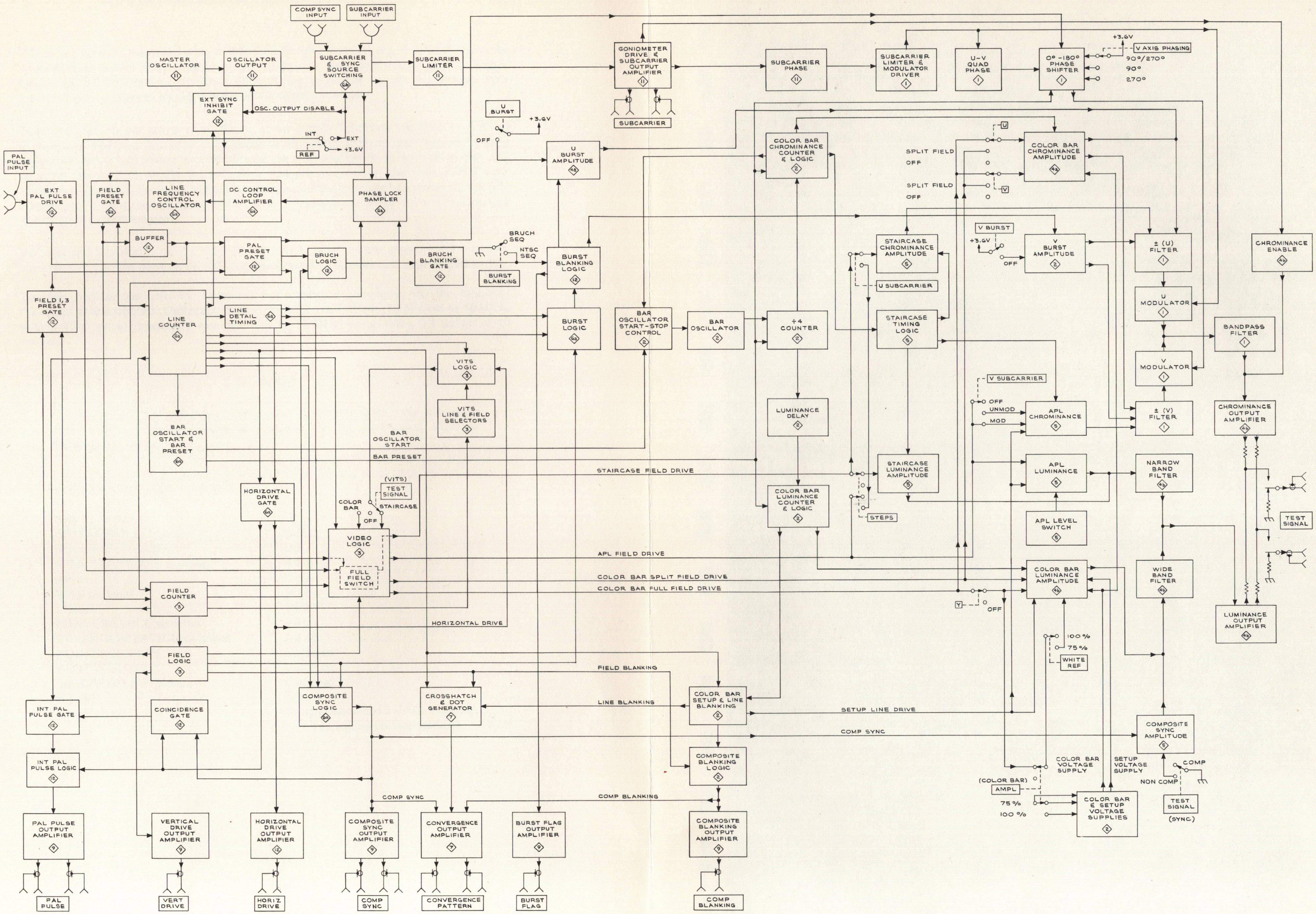

Front or rear-panel control or connector.

Refers to the indicated diagram.


Connection soldered to circuit board.

Blue line encloses components located on circuit board.

Test point.


COMP SYNC INPUT
SUBCARRIER INPUT
MASTER OSCILLATOR
OSCILLATOR OUTPUT
SUBCARRIER & SYNC SOURCE SWITCHING
SUBCARRIER LIMITER
GONIOMETER DRIVE & SUBCARRIER OUTPUT AMPLIFIER
SUBCARRIER
SUBCARRIER PHASE
SUBCARRIER LIMITER & MODULATOR DRIVER
U-V QUAD PHASE
0° -180° PHASE SHIFTER
V AXIS PHASING
90°/270°
90°
270°
+3.6V
EXT SYNC INHIBIT GATE
OSC. OUTPUT DISABLE
INT
EXT
REF
U BURST
OFF
U BURST AMPLITUDE
PAL PULSE INPUT
EXT PAL PULSE DRIVE
FIELD PRESET GATE
LINE FREQUENCY CONTROL OSCILLATOR
DC CONTROL LOOP AMPLIFIER
PHASE LOCK SAMPLER
BUFFER
PAL PRESET GATE
BRUCH LOGIC
BRUCH BLANKING GATE
BRUCH SEQ
NTSC SEQ
BURST BLANKING
BURST BLANKING LOGIC
COLOR BAR CHROMINANCE COUNTER & LOGIC
SPLIT FIELD
OFF
COLOR BAR CHROMINANCE AMPLITUDE
U
V
STAIRCASE CHROMINANCE AMPLITUDE
U SUBCARRIER
V BURST
V BURST AMPLITUDE
± (U) FILTER
CHROMINANCE ENABLE
FIELD 1,3 PRESET GATE
LINE COUNTER
LINE DETAIL TIMING
BURST LOGIC
BAR OSCILLATOR START-STOP CONTROL
BAR OSCILLATOR
÷4 COUNTER
STAIRCASE TIMING LOGIC
U MODULATOR
BANDPASS FILTER
VITS LOGIC
VITS LINE & FIELD SELECTORS
V MODULATOR
V SUBCARRIER
UNMOD
MOD
LUMINANCE DELAY
APL CHROMINANCE
± (V) FILTER
CHROMINANCE OUTPUT AMPLIFIER
BAR OSCILLATOR START & BAR PRESET
BAR OSCILLATOR START
BAR PRESET
STAIRCASE FIELD DRIVE
STAIRCASE LUMINANCE AMPLITUDE
APL LUMINANCE
NARROW BAND FILTER
HORIZONTAL DRIVE GATE
COLOR BAR
(VITS)
TEST SIGNAL
STAIRCASE
VIDEO LOGIC
FULL FIELD SWITCH
COLOR BAR LUMINANCE COUNTER & LOGIC
STEPS
APL LEVEL SWITCH
TEST SIGNAL
APL FIELD DRIVE
COLOR BAR SPLIT FIELD DRIVE
COLOR BAR FULL FIELD DRIVE
FIELD COUNTER
COLOR BAR LUMINANCE AMPLITUDE
WIDE BAND FILTER
Y
HORIZONTAL DRIVE
100%
75%
WHITE REF
LUMINANCE OUTPUT AMPLIFIER
FIELD LOGIC
FIELD BLANKING
LINE BLANKING
SETUP LINE DRIVE
COMP SYNC
INT PAL PULSE GATE
COINCIDENCE GATE
COMPOSITE SYNC LOGIC
CROSSHATCH & DOT GENERATOR
COLOR BAR SETUP & LINE BLANKING
COMPOSITE SYNC AMPLITUDE
INT PAL PULSE LOGIC
COMPOSITE BLANKING LOGIC
COLOR BAR VOLTAGE SUPPLY
SETUP VOLTAGE SUPPLY
COMP
NON COMP
(COLOR BAR)
AMPL
75%
100%
COLOR BAR & SETUP VOLTAGE SUPPLIES
(SYNC.)
COMP BLANKING
PAL PULSE OUTPUT AMPLIFIER
VERTICAL DRIVE OUTPUT AMPLIFIER
HORIZONTAL DRIVE OUTPUT AMPLIFIER
COMPOSITE SYNC OUTPUT AMPLIFIER
CONVERGENCE OUTPUT AMPLIFIER
BURST FLAG OUTPUT AMPLIFIER
COMPOSITE BLANKING OUTPUT AMPLIFIER
PAL PULSE
VERT DRIVE
HORIZ DRIVE
COMP SYNC
CONVERGENCE PATTERN
BURST FLAG
COMP BLANKING

1

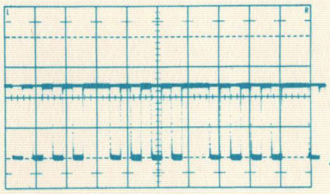
500 mV/CM

+4.2 V

0.1 μs/CM

2

* *



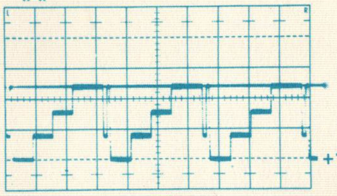
100 mV/CM

+1.5 V

20 μs/CM

3

* *



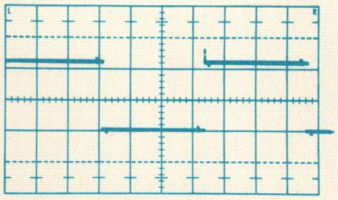
100 mV/CM

+1.5 V

20 μs/CM

4

* * *



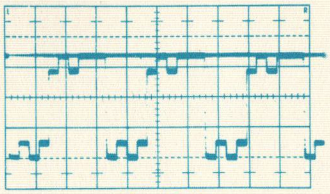
500 mV/CM

+0.2 V

20 μs/CM

5

* *



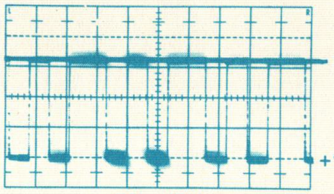
100 mV/CM

+1.4 V

20 μs/CM

6

* *



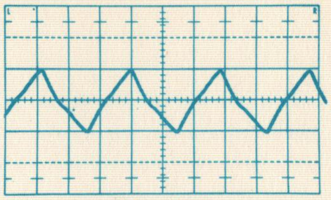
100 mV/CM

+1.4 V

20 μs/CM

7

*



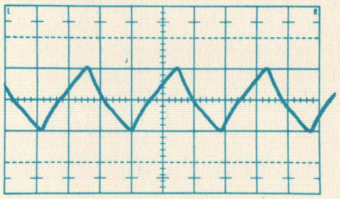
500 mV/CM

0 V

0.1 μs/CM

8

*



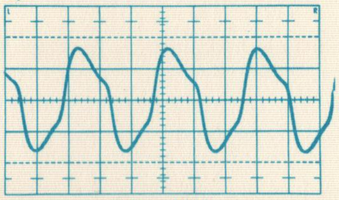
500 mV/CM

0 V

0.1 μs/CM

9

*



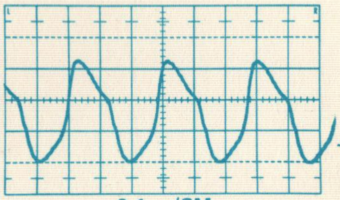
1 V/CM

0 V

0.1 μs/CM

10

*



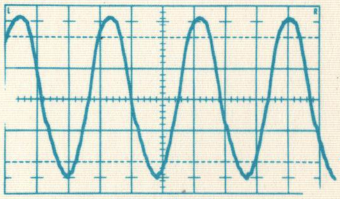
1 V/CM

+5.4 V

0.1 μs/CM

11

*



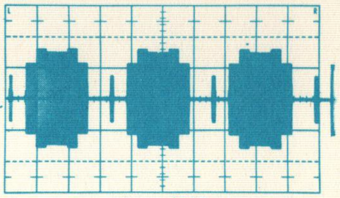
1 V/CM

+5.8 V

0.1 μs/CM

12

* *

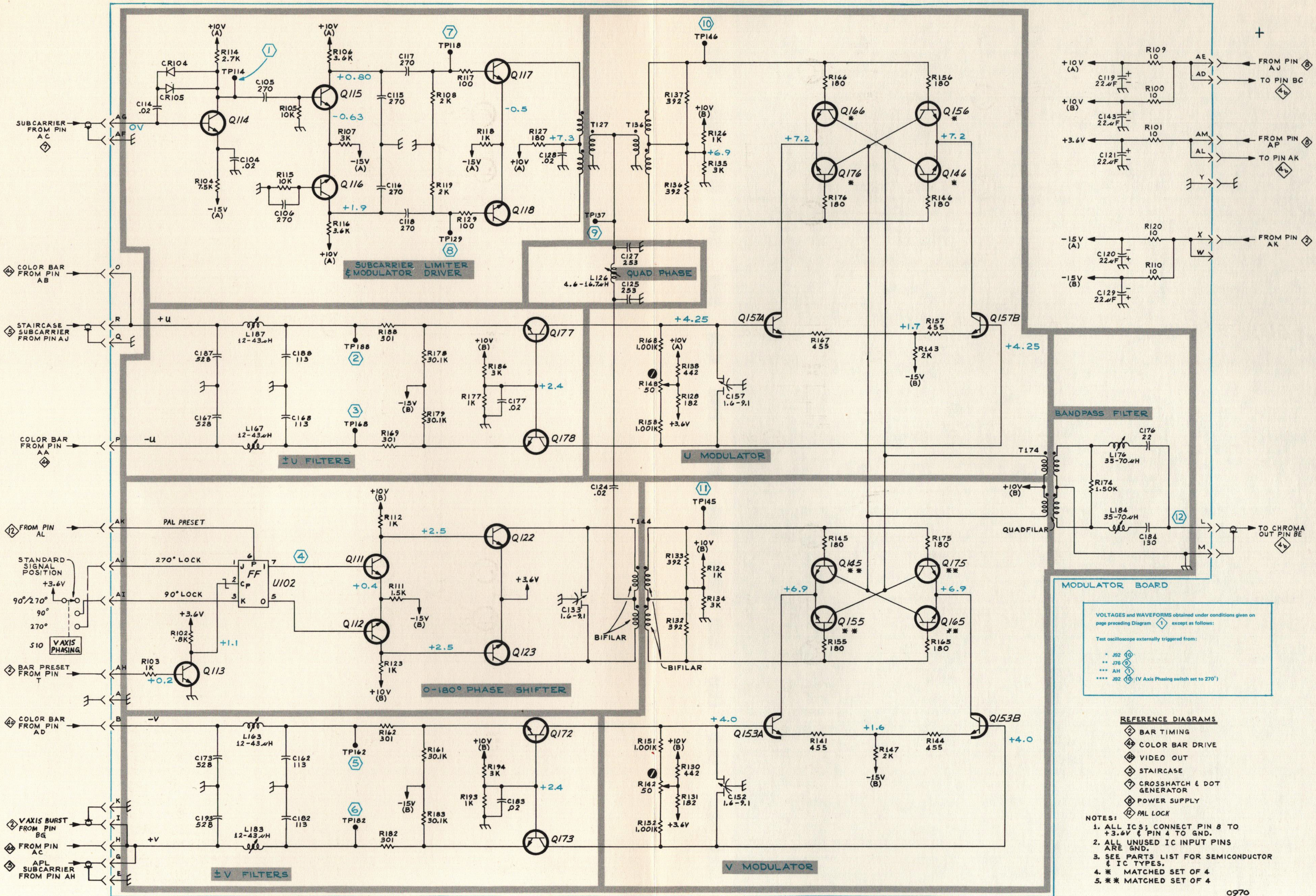


500 mV/CM

0 V

20 μs/CM

WAVEFORMS



VOLTAGES and WAVEFORMS obtained under conditions given on page preceding Diagram 1 except as follows:

Test oscilloscope externally triggered from:

- * J92 10
- ** J76 9
- *** AH 1
- **** J92 10 (V Axis Phasing switch set to 270°)

REFERENCE DIAGRAMS

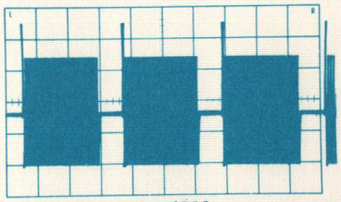
- 2 BAR TIMING
- 4a COLOR BAR DRIVE
- 4b VIDEO OUT
- 5 STAIRCASE
- 7 CROSSHATCH & DOT GENERATOR
- 8 POWER SUPPLY
- 12 PAL LOCK

NOTES:
1. ALL ICS; CONNECT PIN 8 TO +3.6V & PIN 4 TO GND.
2. ALL UNUSED IC INPUT PINS ARE GND.
3. SEE PARTS LIST FOR SEMICONDUCTOR & IC TYPES.
4. * MATCHED SET OF 4
5. ** MATCHED SET OF 4

0970

1

2 V/CM



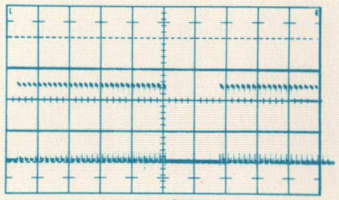
0 V

20 μs/CM

2

*

500 mV/CM



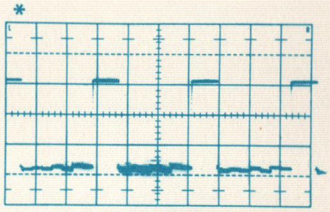
0 V

10 μs/CM

3

*

1 V/CM



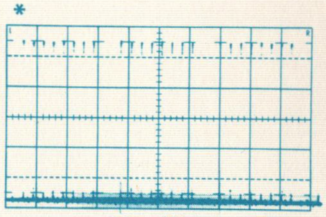
0 V

20 μs/CM

4

*

200 mV/CM



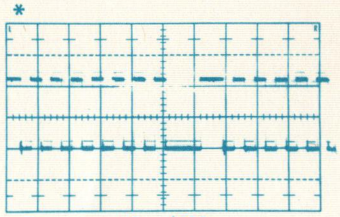
0 V

20 μs/CM

5

*

500 mV/CM



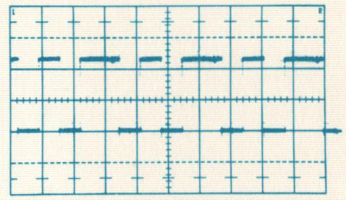
+0.1 V

10 μs/CM

6

*

500 mV/CM



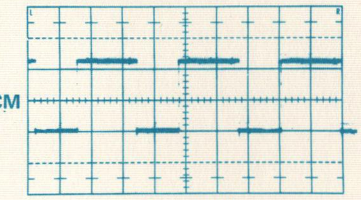
+0.2 V

20 μs/CM

7

*

500 mV/CM



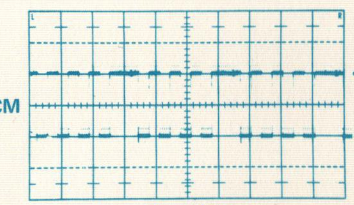
+0.2 V

20 μs/CM

8

*

500 mV/CM



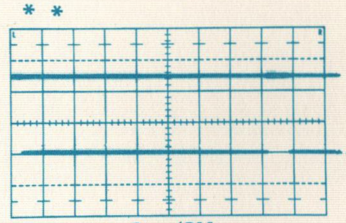
+0.2 V

20 μs/CM

9

* *

1 V/CM



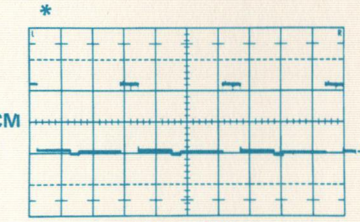
+0.2 V

2 ms/CM

10

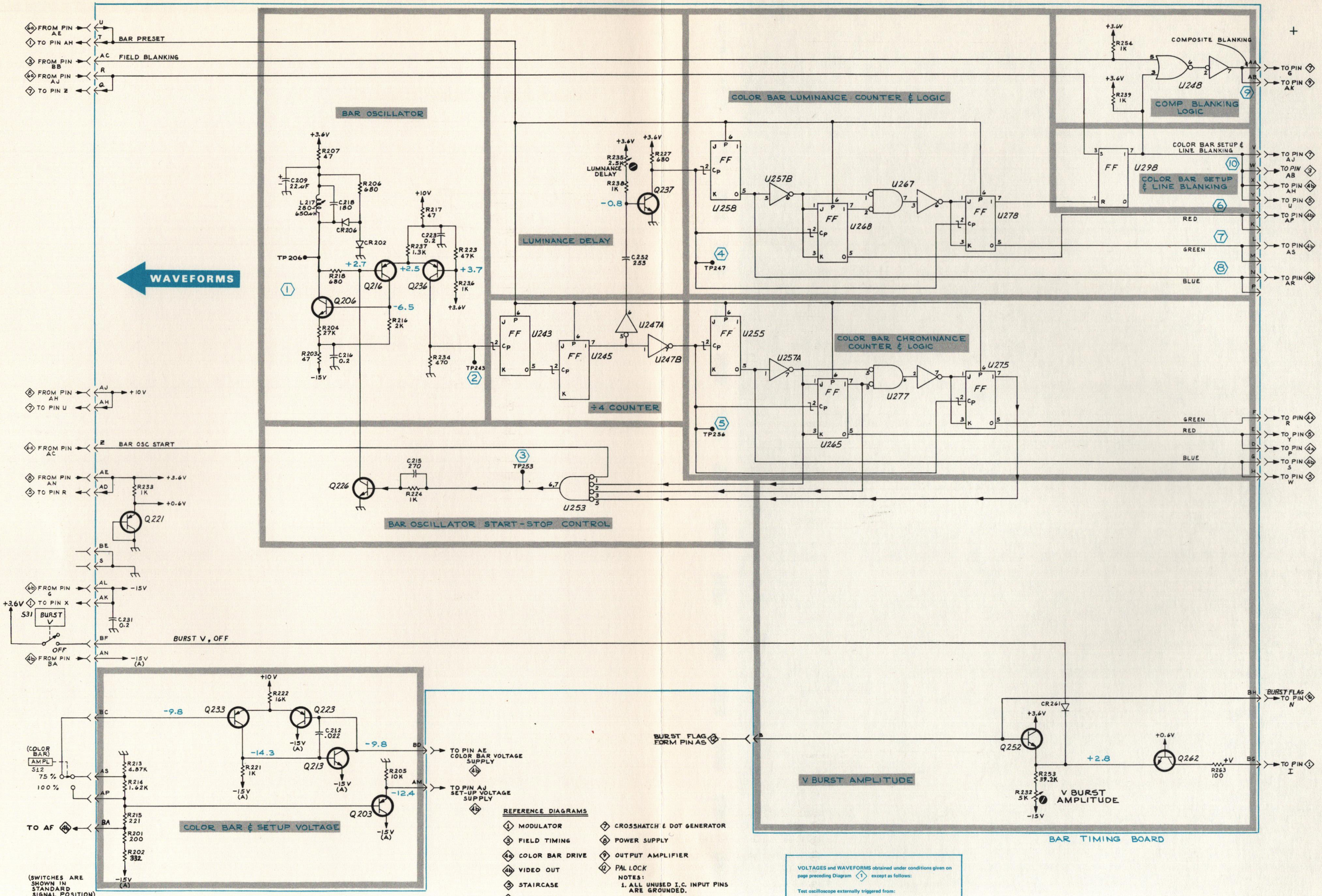
*

500 mV/CM



+0.2 V

20 μs/CM



REFERENCE DIAGRAMS

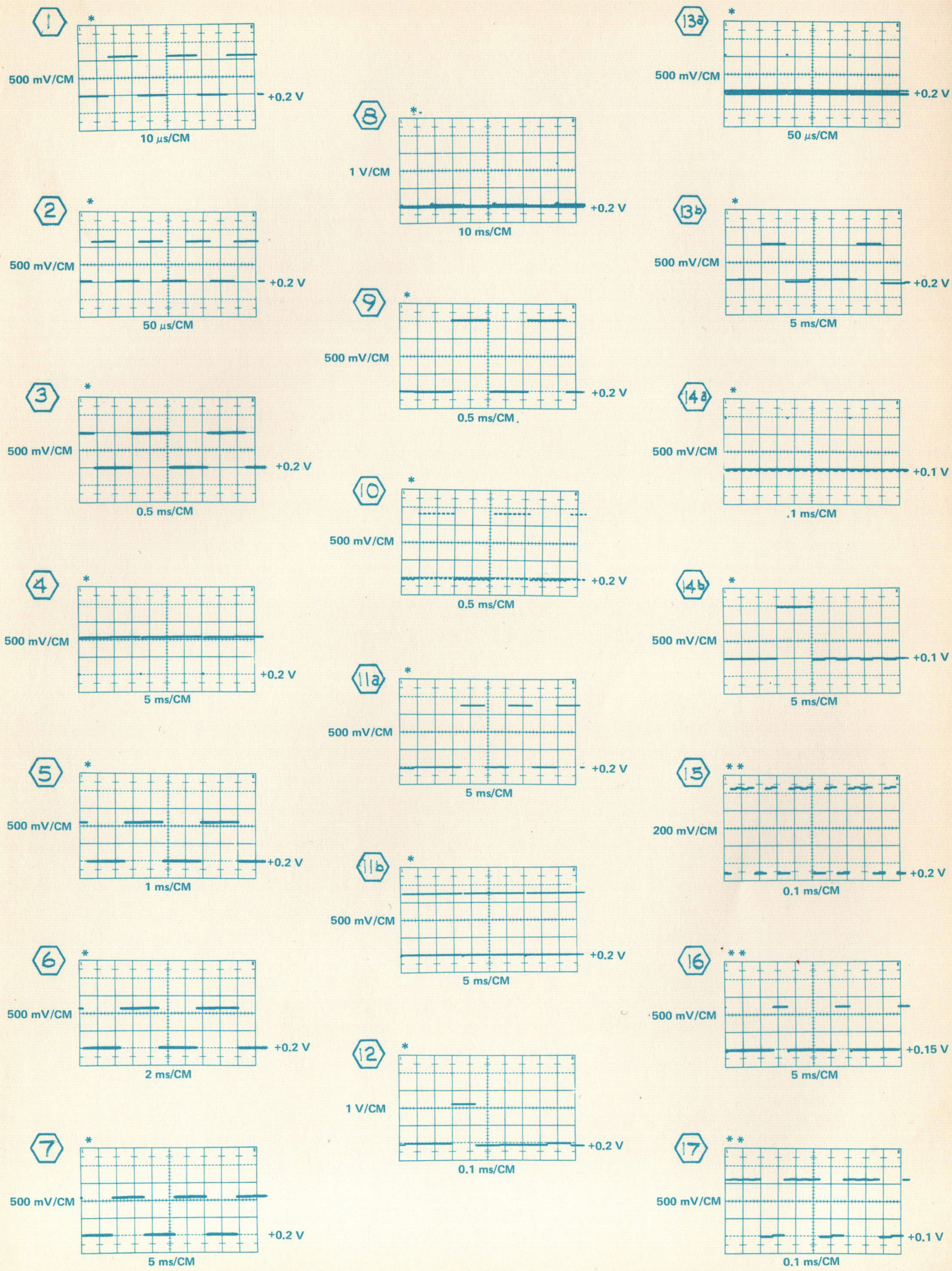
1 MODULATOR
3 FIELD TIMING
4a COLOR BAR DRIVE
4b VIDEO OUT
5 STAIRCASE
6 LINE TIMING
6a SUBCARRIER & SYNC SOURCE SWITCHING
7 CROSSHATCH & DOT GENERATOR
8 POWER SUPPLY
9 OUTPUT AMPLIFIER
12 PAL LOCK

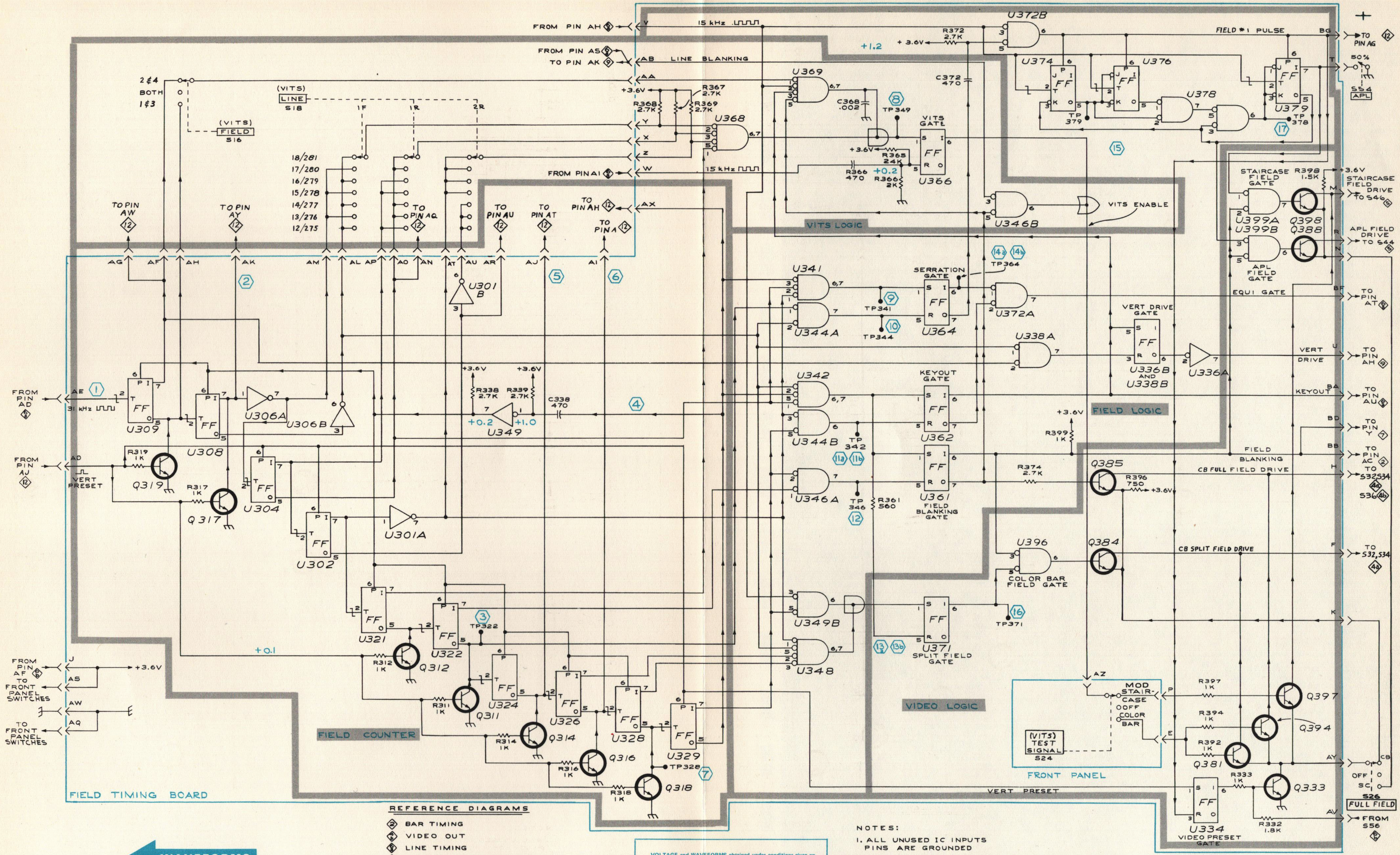
NOTES:
1. ALL UNUSED I.C. INPUT PINS ARE GROUNDED.
2. SEE PARTS LIST FOR SEMICONDUCTOR & I C TYPES.
3. ALL I.C.s: CONNECT PIN 8 TO +3.6V & PIN 4 TO GND.

VOLTAGES and WAVEFORMS obtained under conditions given on page preceding Diagram 1 except as follows:

Test oscilloscope externally triggered from:

* – J76 9
** – J80 9


1
*
500 mV/CM
+0.2 V
10 μs/CM
2
*
500 mV/CM
+0.2 V
50 μs/CM
3
*
500 mV/CM
+0.2 V
0.5 ms/CM
4
*
500 mV/CM
+0.2 V
5 ms/CM
5
*
500 mV/CM
+0.2 V
1 ms/CM
6
*
500 mV/CM
+0.2 V
2 ms/CM
7
*
500 mV/CM
+0.2 V
5 ms/CM
8
*
1 V/CM
+0.2 V
10 ms/CM
9
*
500 mV/CM
+0.2 V
0.5 ms/CM
10
*
500 mV/CM
+0.2 V
0.5 ms/CM
11a
*
500 mV/CM
+0.2 V
5 ms/CM
11b
*
500 mV/CM
+0.2 V
5 ms/CM
12
*
1 V/CM
+0.2 V
0.1 ms/CM
13a
*
500 mV/CM
+0.2 V
50 μs/CM
13b
*
500 mV/CM
+0.2 V
5 ms/CM
14a
*
500 mV/CM
+0.1 V
.1 ms/CM
14b
*
500 mV/CM
+0.1 V
5 ms/CM
15
* *
200 mV/CM
+0.2 V
0.1 ms/CM
16
* *
500 mV/CM
+0.15 V
5 ms/CM
17
* *
500 mV/CM
+0.1 V
0.1 ms/CM



REFERENCE DIAGRAMS

- 2 BAR TIMING
- 4 VIDEO OUT
- 5 LINE TIMING
- 6 SUBCARRIER & SYNC SOURCE SWITCHING
- 8 CROSSHATCH & DOT GENERATOR
- 9 OUTPUT AMPLIFIERS
- 12 PAL LOCK

WAVEFORMS

VOLTAGE and WAVEFORMS obtained under conditions given on page preceding Diagram 1 except as follows:

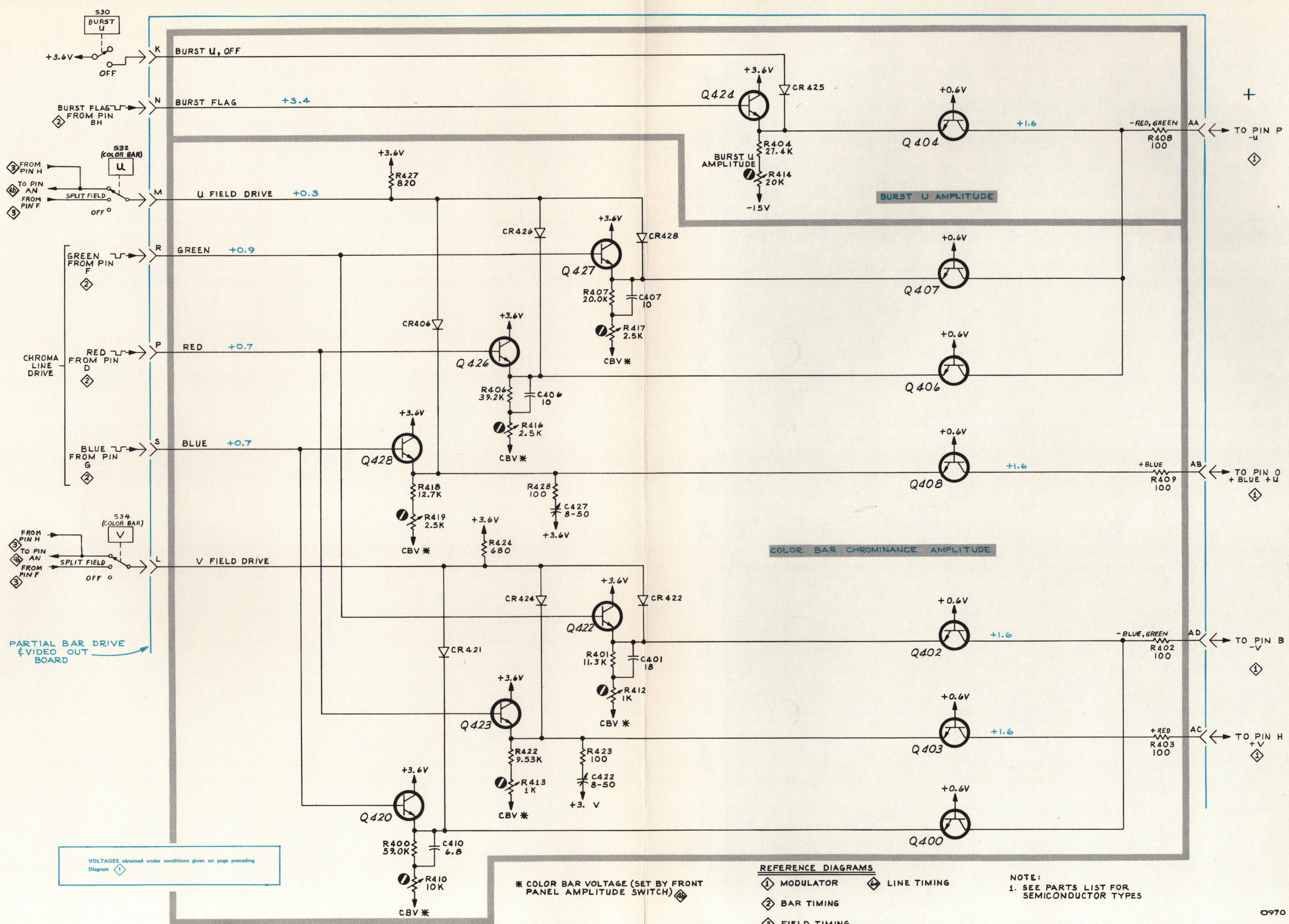
Test oscilloscope externally triggered from:

* – Pin 5 of U342
** – V of 3 (APL% switch to 50/50)

NOTES:

1. ALL UNUSED IC INPUTS PINS ARE GROUNDED
2. SEE PARTS LIST FOR SEMICONDUCTOR & I.C. TYPES
3. NO CONNECTION TO PIN 8, U348 & U368.
4. ALL OTHER I.C.'S; CONNECT PIN 8 TO +3.6V.
5. ALL I.C.'S; CONNECT PIN 4 TO GROUND.
6. SWITCHES ARE SHOWN IN STANDARD SIGNAL POSITION

0970



VOLTAGES obtained under conditions given on page preceding Diagram 1

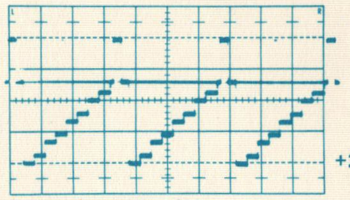
* COLOR BAR VOLTAGE (SET BY FRONT PANEL AMPLITUDE SWITCH) 4b

REFERENCE DIAGRAMS
1 MODULATOR
2 BAR TIMING
3 FIELD TIMING
4b LINE TIMING

NOTE:
1. SEE PARTS LIST FOR SEMICONDUCTOR TYPES

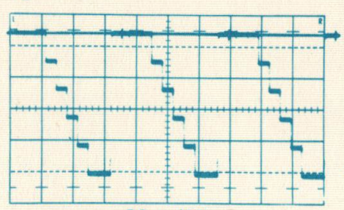
0970

1



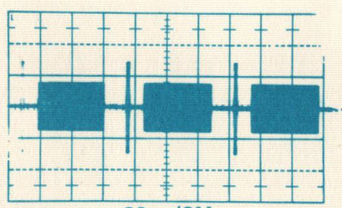
100 mV/CM
+2.3 V
20 μs/CM

2



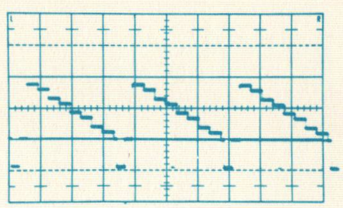
*
100 mV/CM
+2.2 V
20 μs/CM

3

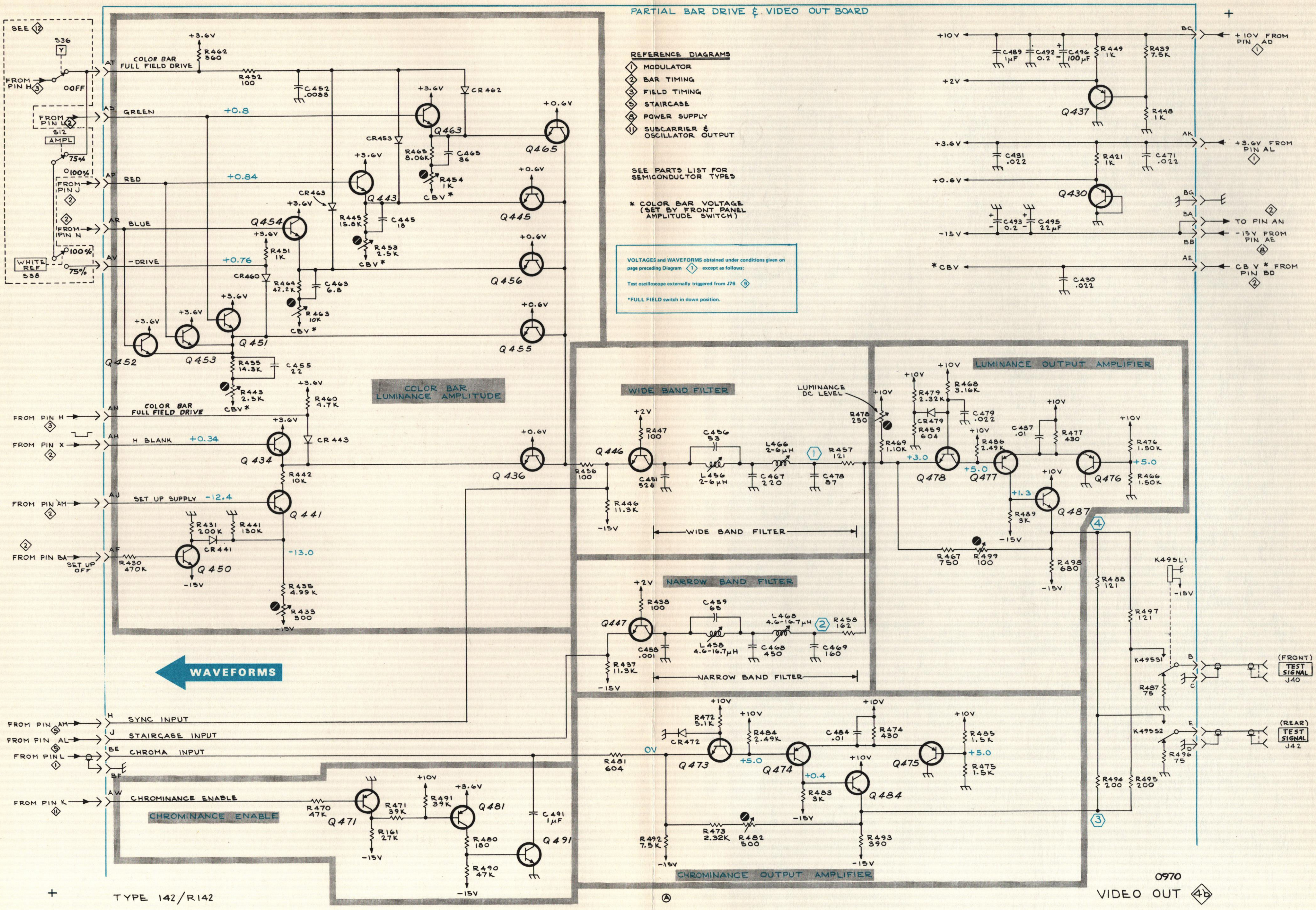


500 mV/CM
-0.1 V
20 μs/CM

4



1 V/CM
0 V
20 μs/CM



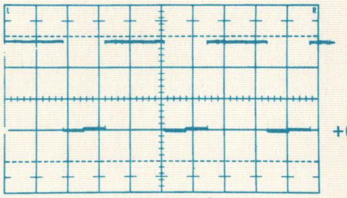
0970

TYPE 142/R142

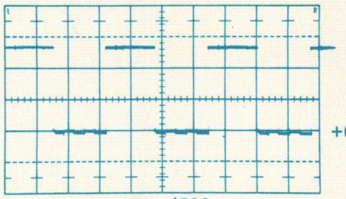
VIDEO OUT 4b

VIDEO OUT

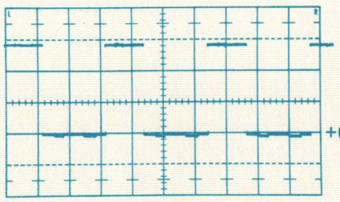
1



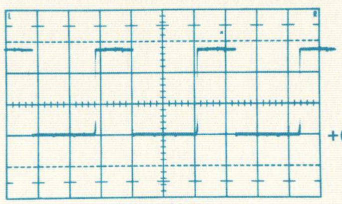
2



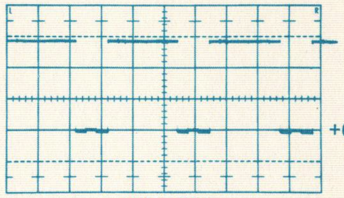
3



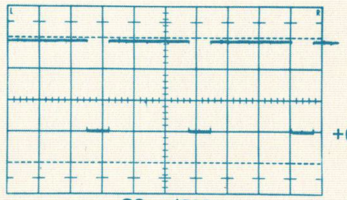
4



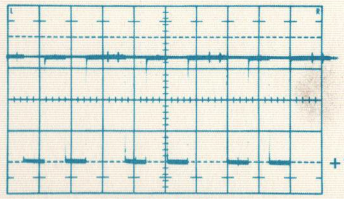
5



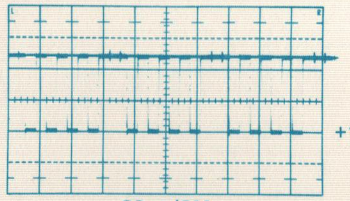
6



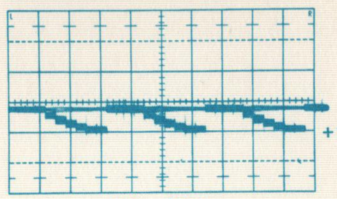
7



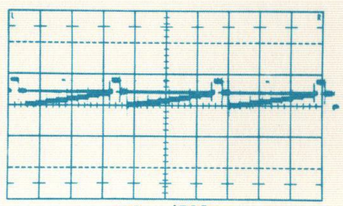
8

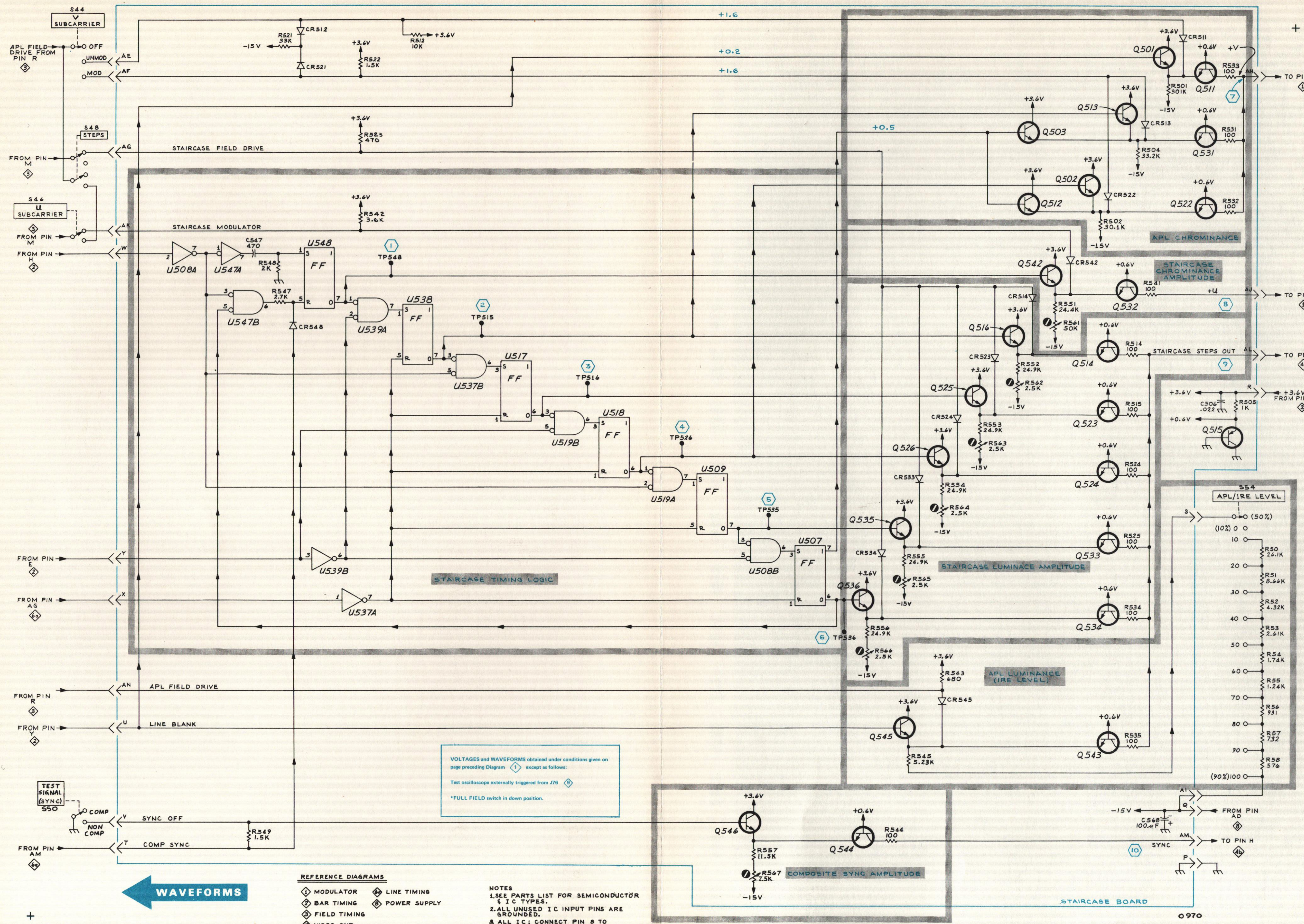


9 *



10



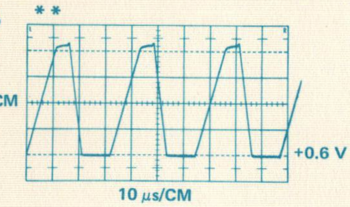


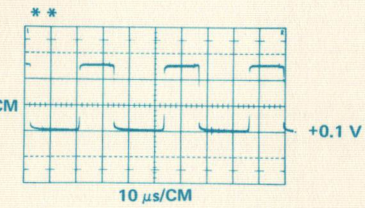
REFERENCE DIAGRAMS

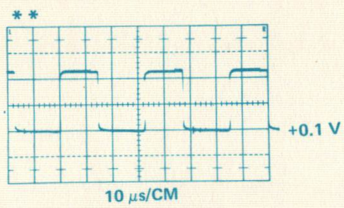
1. MODULATOR
2. BAR TIMING
3. FIELD TIMING
4. VIDEO OUT
6. LINE TIMING
8. POWER SUPPLY

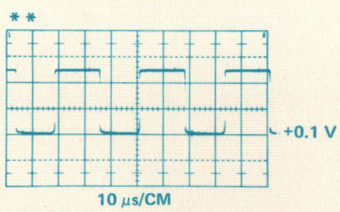
NOTES

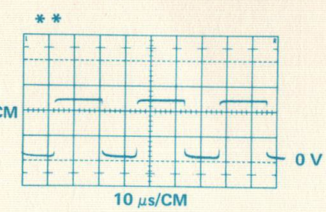
1. SEE PARTS LIST FOR SEMICONDUCTOR & I C TYPES.
2. ALL UNUSED I C INPUT PINS ARE GROUNDED.
3. ALL I C; CONNECT PIN 8 TO +3.6V & PIN 4 TO GROUND.

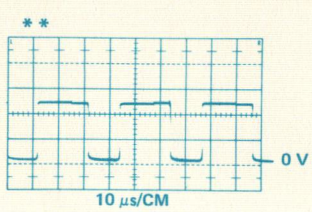
1


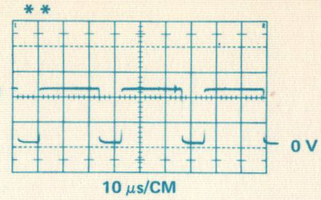
2


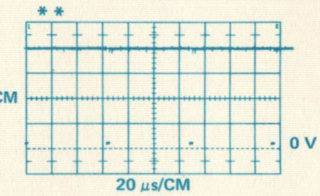
3


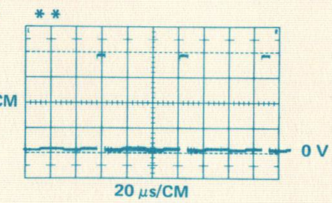
4


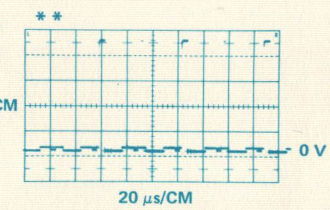
5


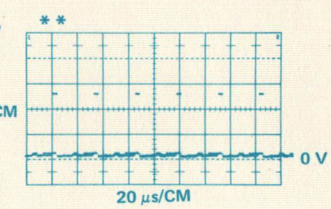
6


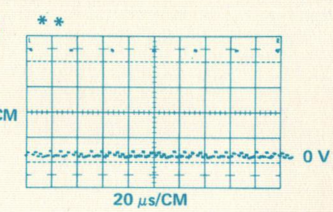
7


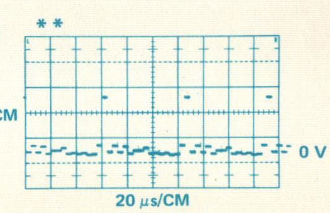
8


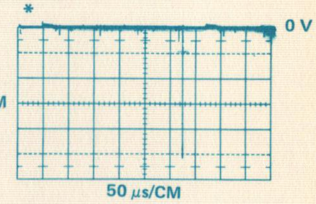
9


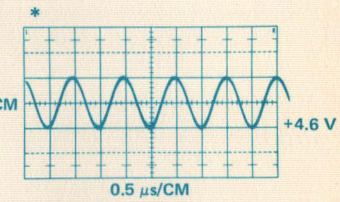
10


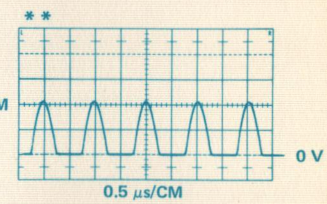
11


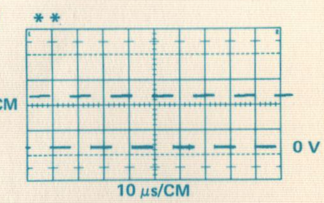
12


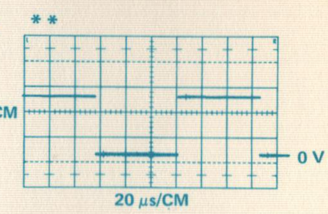
13


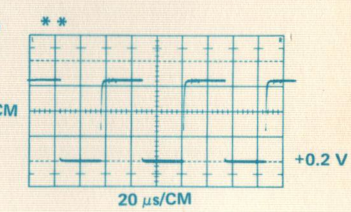
14


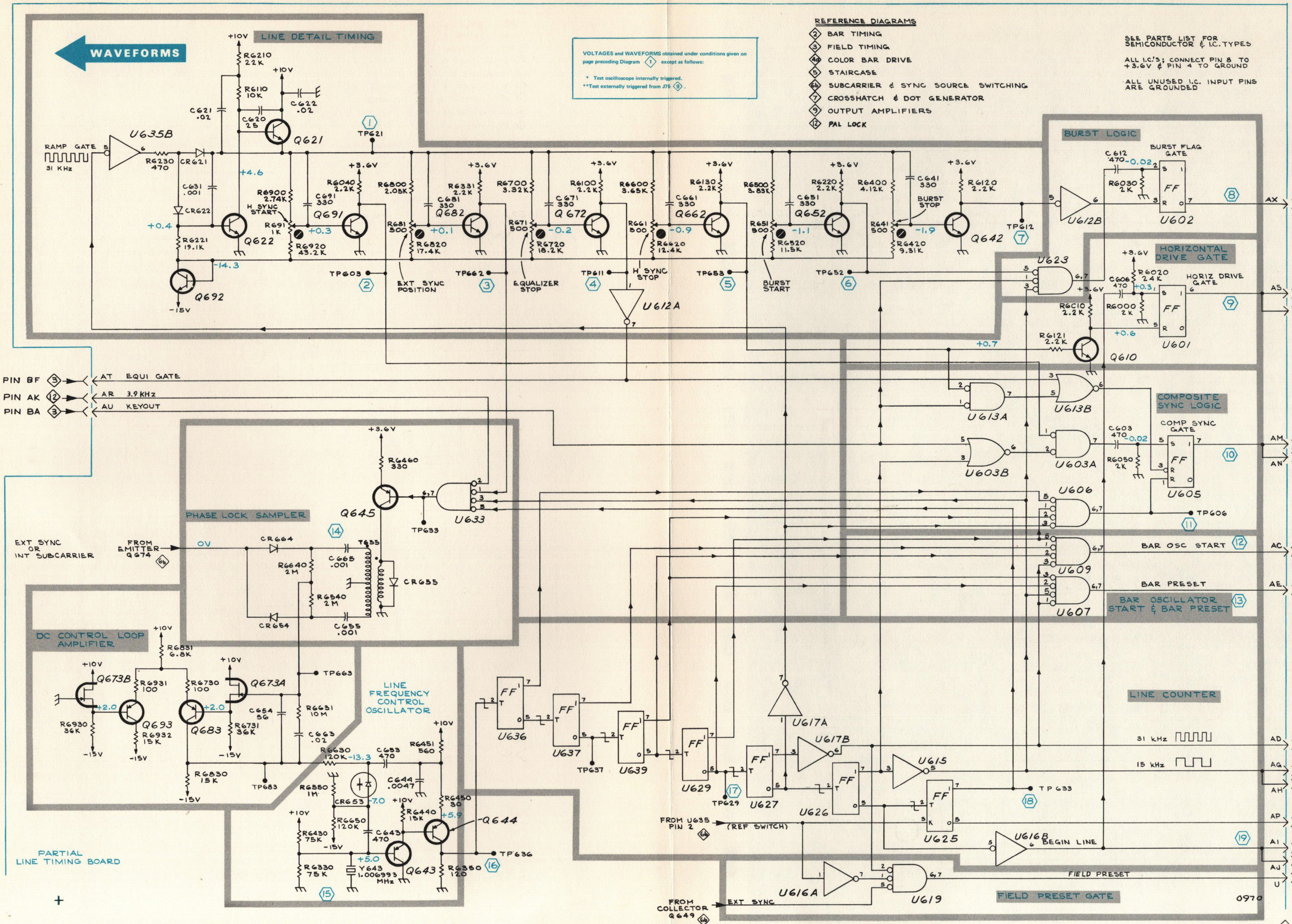
15


16


17


18


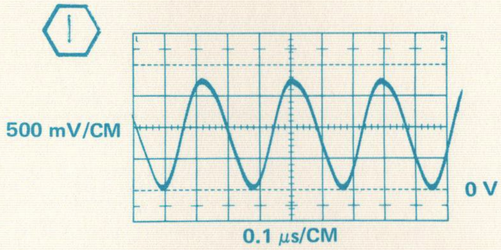
19




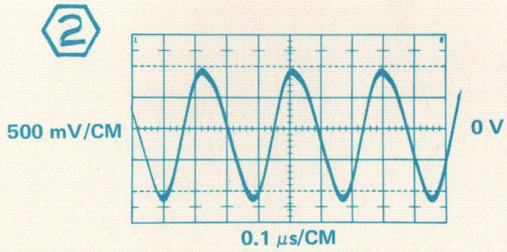
TYPE 142/R142

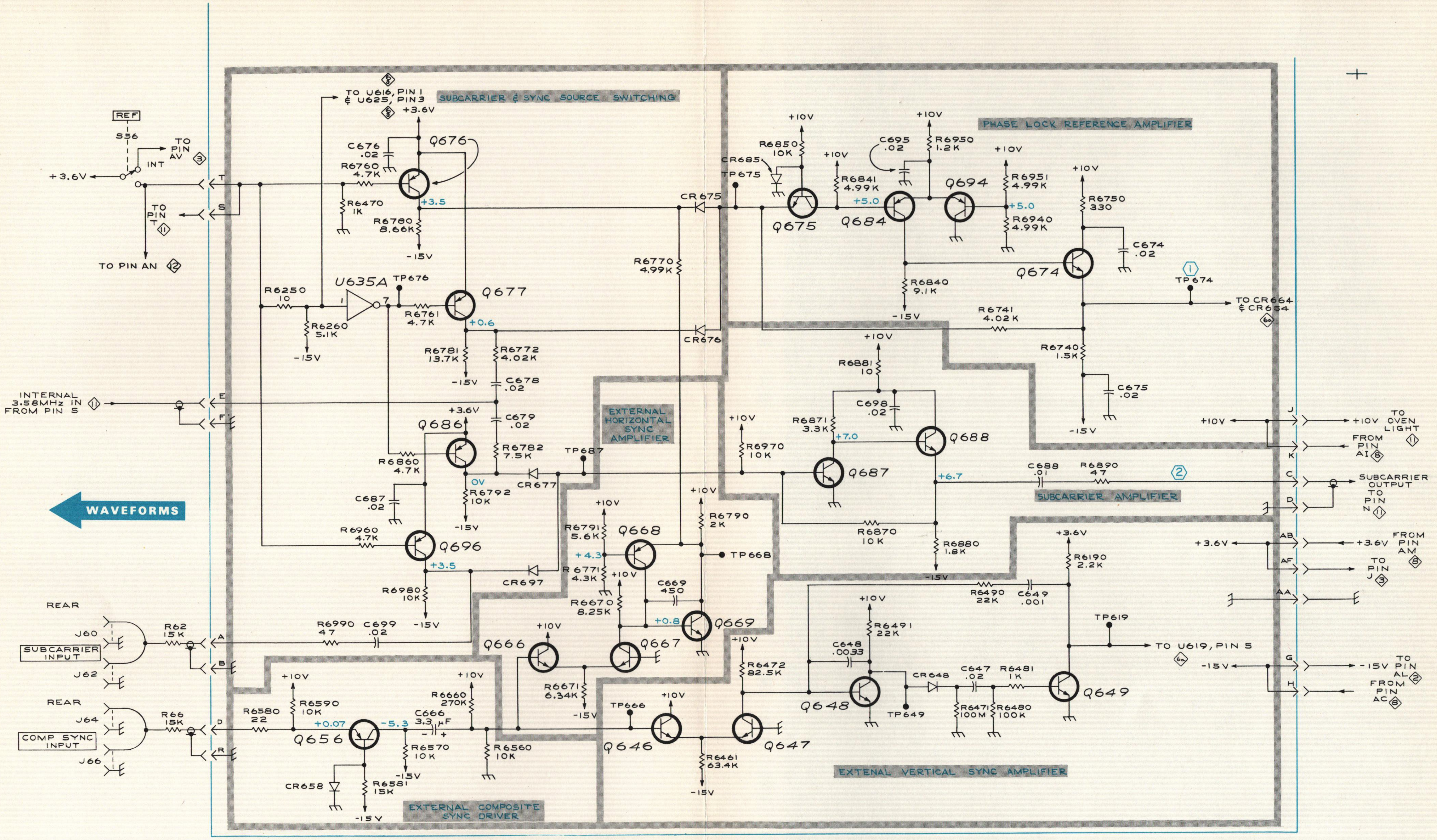
LINE TIMING 6a

1



2





REFERENCE DIAGRAMS

- 2 BAR TIMING
- 3 FIELD TIMING
- 6a LINE TIMING
- 8 POWER SUPPLY
- 1 SUBCARRIER OSCILLATOR & OUTPUT

VOLTAGES and WAVEFORMS obtained under conditions given on page preceding Diagram 1 except as follows:

*Test oscilloscope internally triggered

NOTES:

1. SEE PARTS LIST FOR SEMICONDUCTOR & I.C. TYPES
2. ALL UNUSED I.C. INPUT PINS ARE GROUNDED

TYPE 142/R142

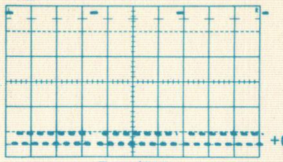
A

0970

SUBCARRIER & SYNC SOURCE SWITCHING 6b

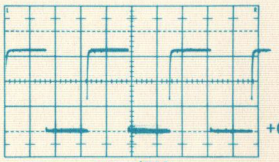
1

*



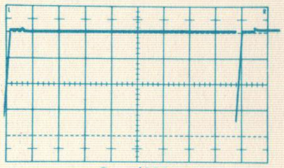
2

**



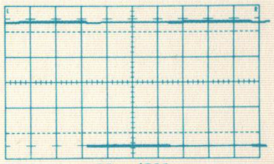
3

*



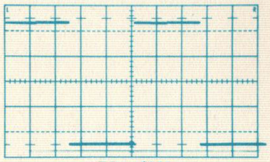
4

*



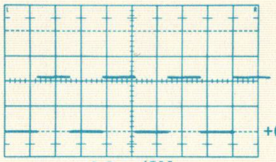
5

*



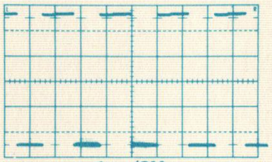
6

*



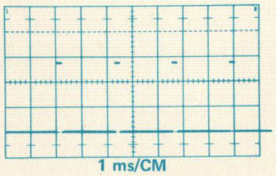
7

*



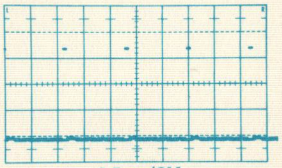
8

*



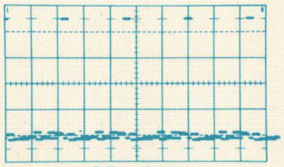
9

***



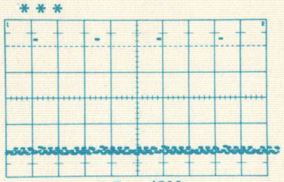
10

***



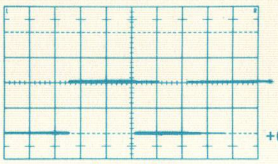
11

***



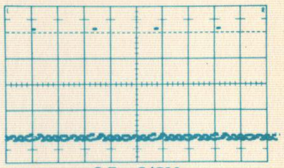
12

*



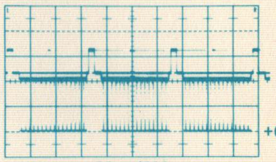
13

***



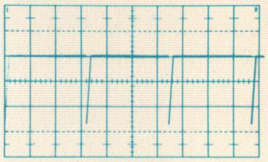
14

**



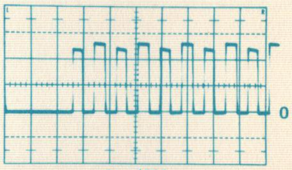
15

**

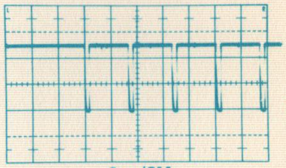


16

**

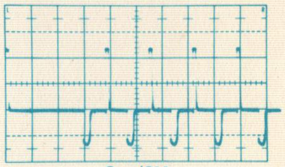


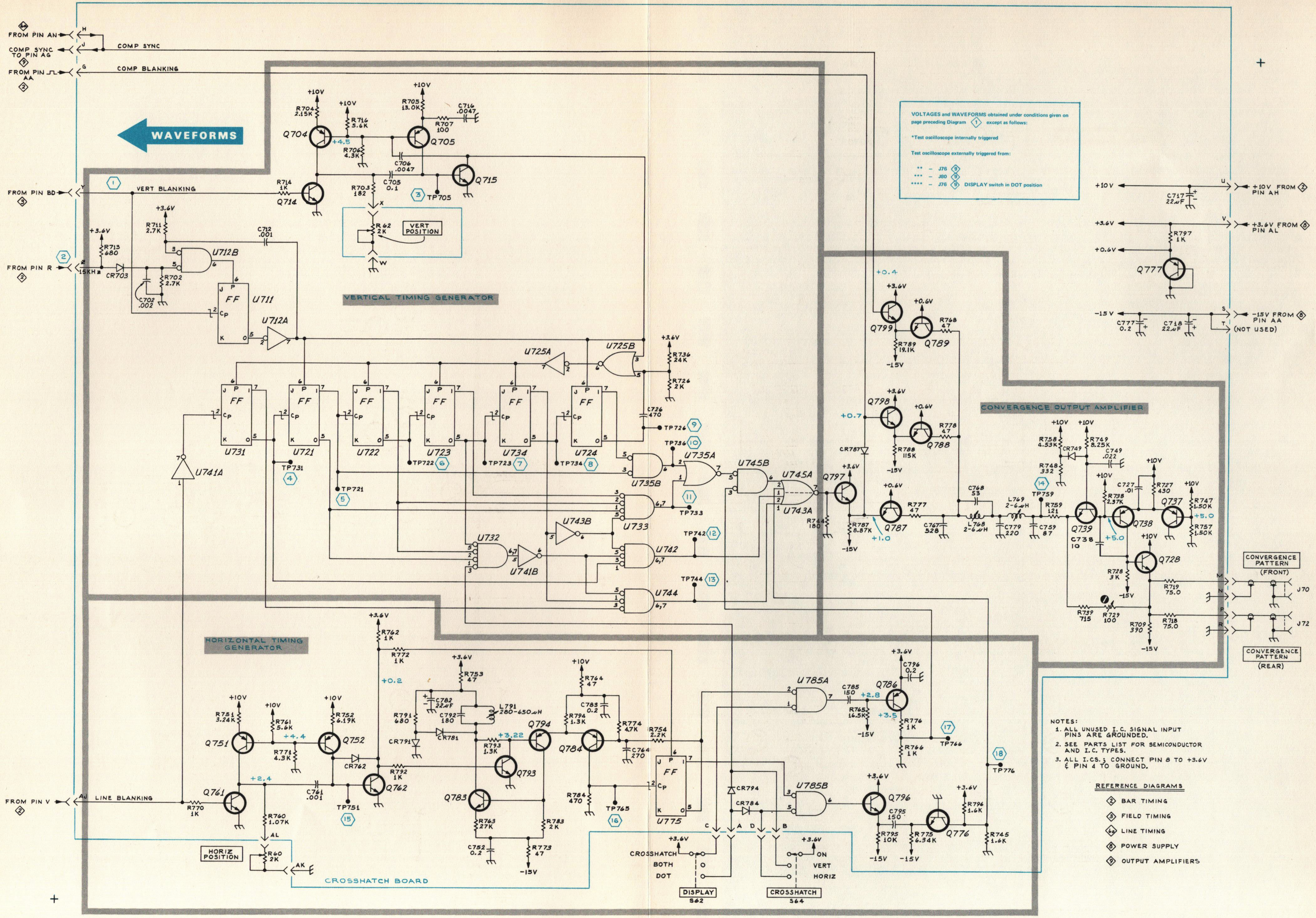
17

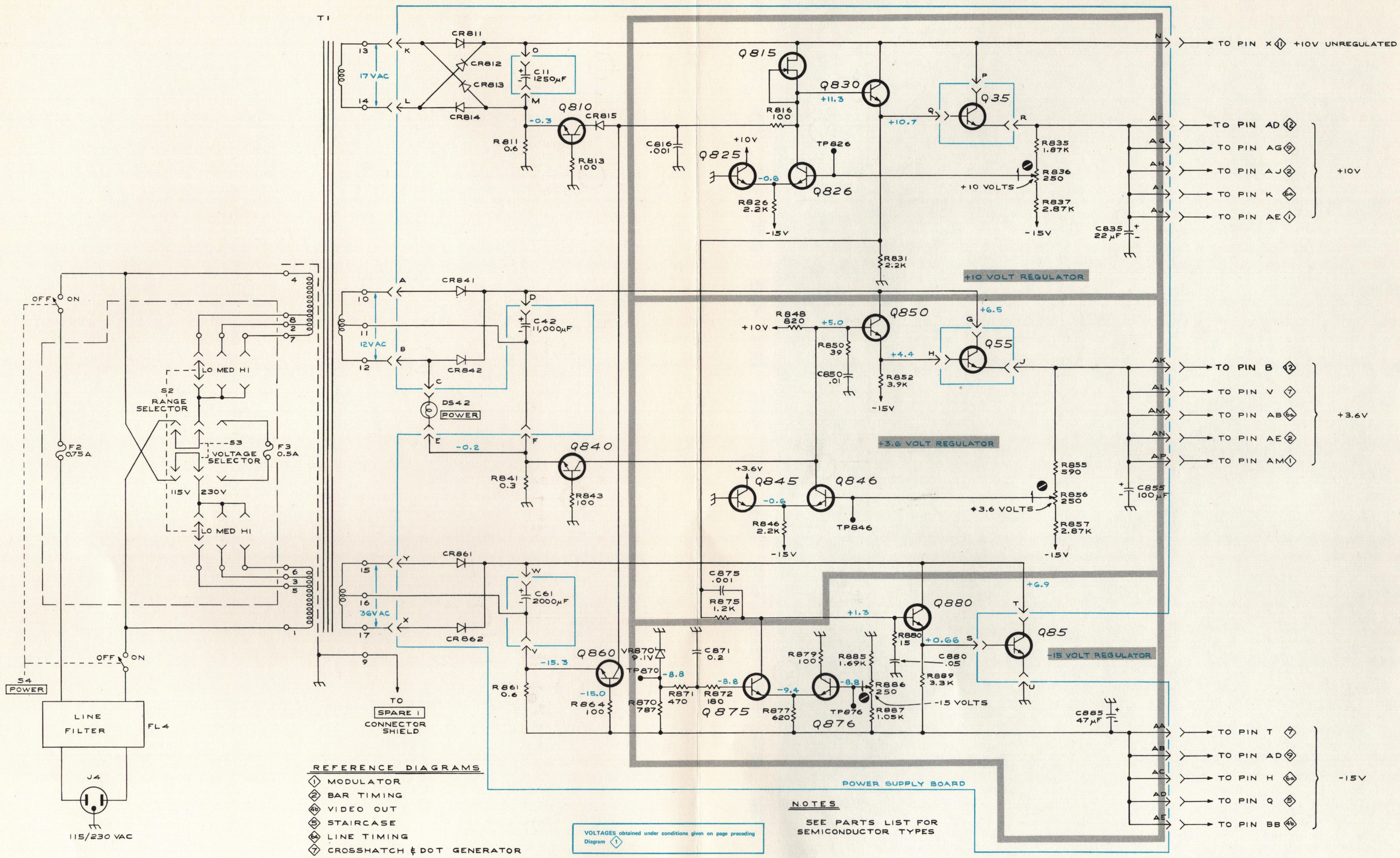


18

**




WAVEFORMS
FROM PIN AN
COMP SYNC TO PIN AG
FROM PIN AA
COMP SYNC
COMP BLANKING
FROM PIN BD
VERT BLANKING
FROM PIN R
15KHz
VERT POSITION
VERTICAL TIMING GENERATOR
HORIZONTAL TIMING GENERATOR
FROM PIN V
LINE BLANKING
HORIZ POSITION
CROSSHATCH BOARD
CONVERGENCE OUTPUT AMPLIFIER
CONVERGENCE PATTERN (FRONT)
CONVERGENCE PATTERN (REAR)
+10V FROM PIN AH
+3.6V FROM PIN AL
−15V FROM PIN AA
(NOT USED)
CROSSHATCH
BOTH
DOT
ON
VERT
HORIZ
DISPLAY S62
CROSSHATCH S64
VOLTAGES and WAVEFORMS obtained under conditions given on page preceding Diagram 1 except as follows:
*Test oscilloscope internally triggered
Test oscilloscope externally triggered from:
** – J76 9
*** – J80 9
**** – J76 9 DISPLAY switch in DOT position
NOTES:
1. ALL UNUSED I.C. SIGNAL INPUT PINS ARE GROUNDED.
2. SEE PARTS LIST FOR SEMICONDUCTOR AND I.C. TYPES.
3. ALL I.CS.; CONNECT PIN 8 TO +3.6V & PIN 4 TO GROUND.
REFERENCE DIAGRAMS
2 BAR TIMING
3 FIELD TIMING
6a LINE TIMING
8 POWER SUPPLY
9 OUTPUT AMPLIFIERS



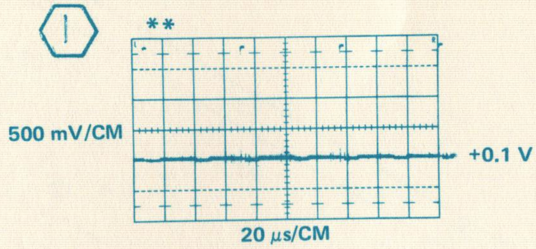
REFERENCE DIAGRAMS

1. MODULATOR
2. BAR TIMING
4b. VIDEO OUT
5. STAIRCASE
6a. LINE TIMING
7. CROSSHATCH & DOT GENERATOR
9. OUTPUT AMPLIFIERS
11. SUBCARRIER OSCILLATOR & OUTPUT
12. PAL LOCK

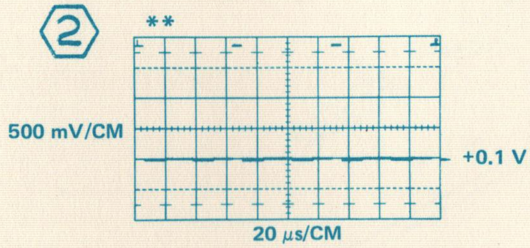
NOTES

SEE PARTS LIST FOR SEMICONDUCTOR TYPES

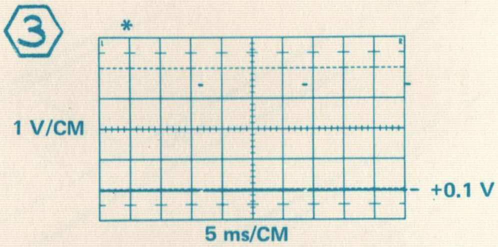
1


**
500 mV/CM
+0.1 V
20 μs/CM

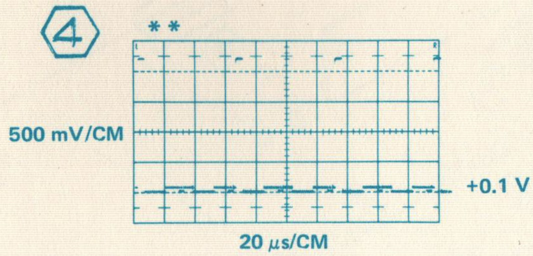
2


**
500 mV/CM
+0.1 V
20 μs/CM

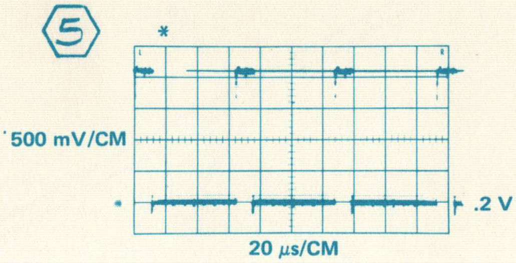
3

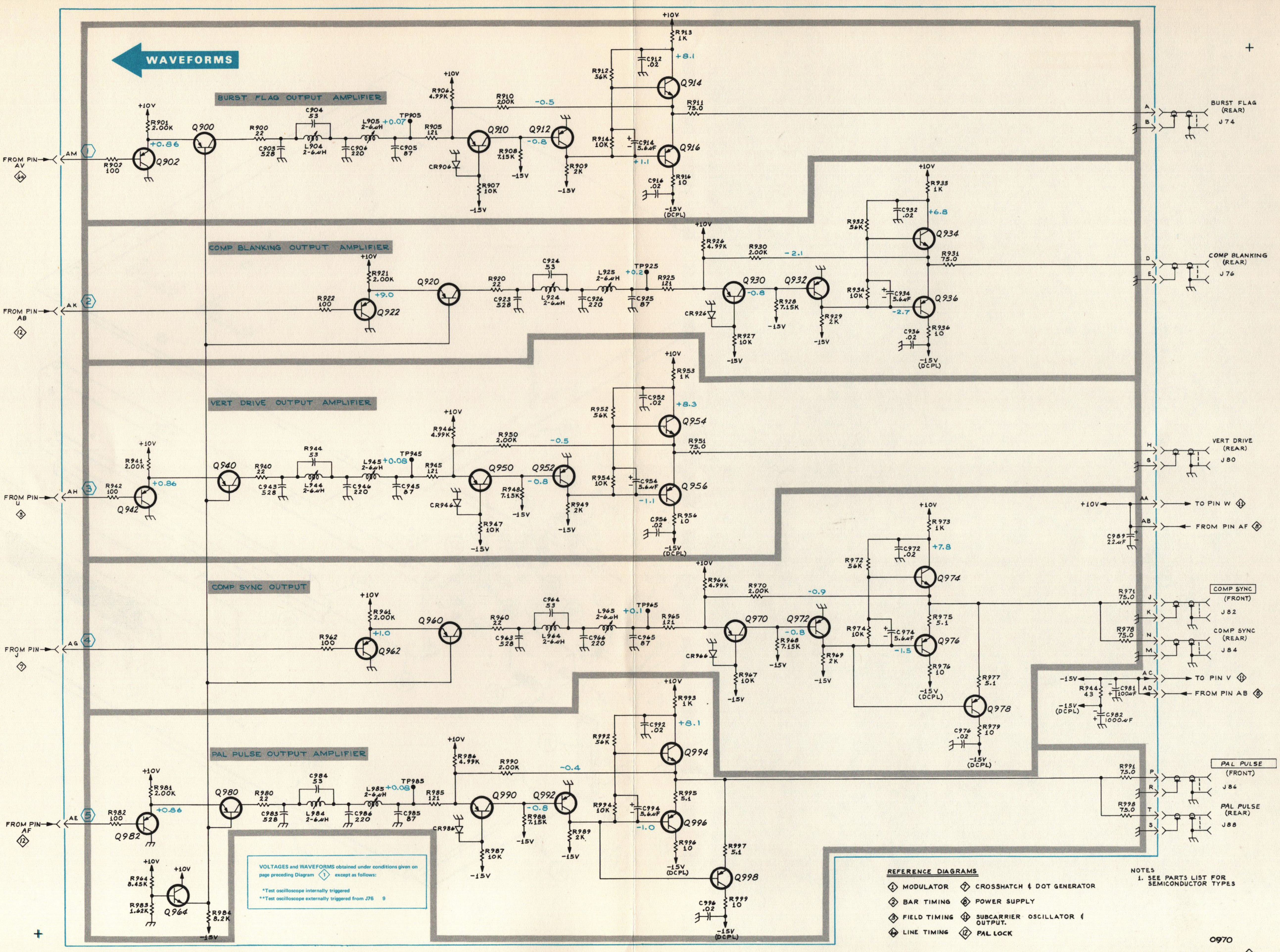

*
1 V/CM
+0.1 V
5 ms/CM

4

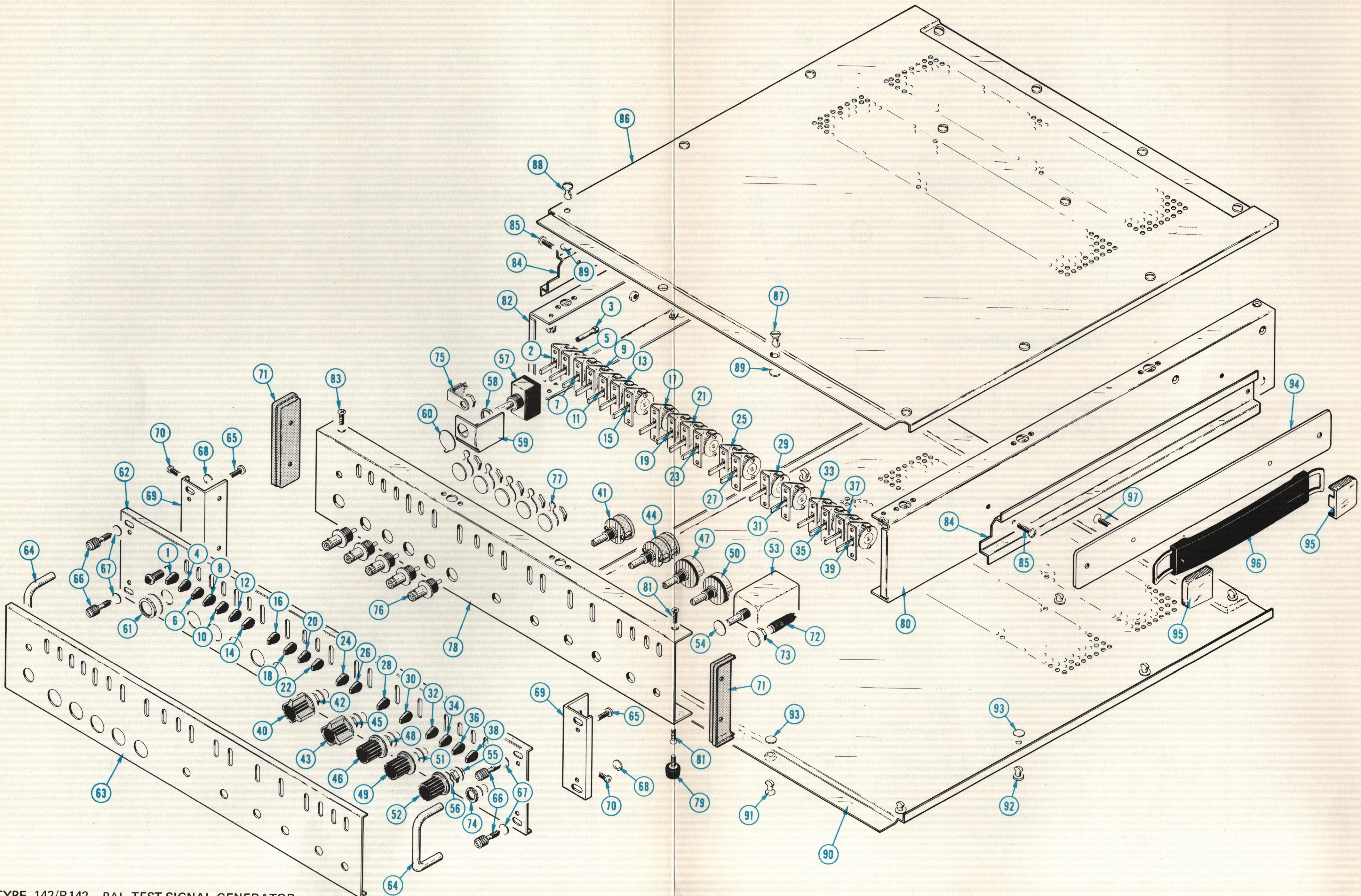

**
500 mV/CM
+0.1 V
20 μs/CM

5


*
500 mV/CM
.2 V
20 μs/CM

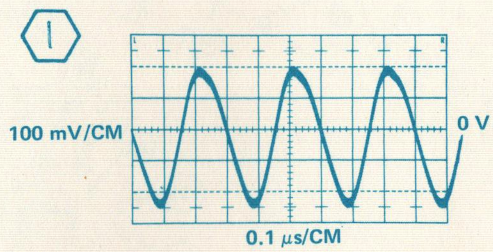

WAVEFORMS
BURST FLAG OUTPUT AMPLIFIER
COMP BLANKING OUTPUT AMPLIFIER
VERT DRIVE OUTPUT AMPLIFIER
COMP SYNC OUTPUT
PAL PULSE OUTPUT AMPLIFIER
FROM PIN AV
FROM PIN AB
FROM PIN U
FROM PIN J
FROM PIN AF
BURST FLAG (REAR) J74
COMP BLANKING (REAR) J76
VERT DRIVE (REAR) J80
TO PIN W
FROM PIN AF
COMP SYNC (FRONT) J82
COMP SYNC (REAR) J84
TO PIN V
FROM PIN AB
PAL PULSE (FRONT) J86
PAL PULSE (REAR) J88
VOLTAGES and WAVEFORMS obtained under conditions given on page preceding Diagram 1 except as follows:
*Test oscilloscope internally triggered
**Test oscilloscope externally triggered from J76 9
REFERENCE DIAGRAMS
1 MODULATOR
2 BAR TIMING
3 FIELD TIMING
4 LINE TIMING
7 CROSSHATCH & DOT GENERATOR
8 POWER SUPPLY
11 SUBCARRIER OSCILLATOR & OUTPUT.
12 PAL LOCK
NOTES
1. SEE PARTS LIST FOR SEMICONDUCTOR TYPES

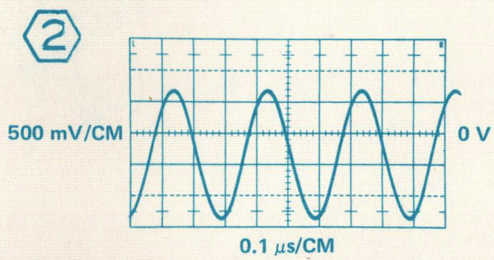
0970

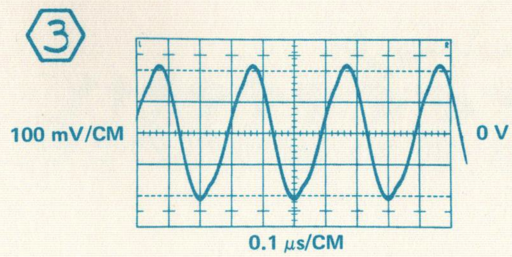


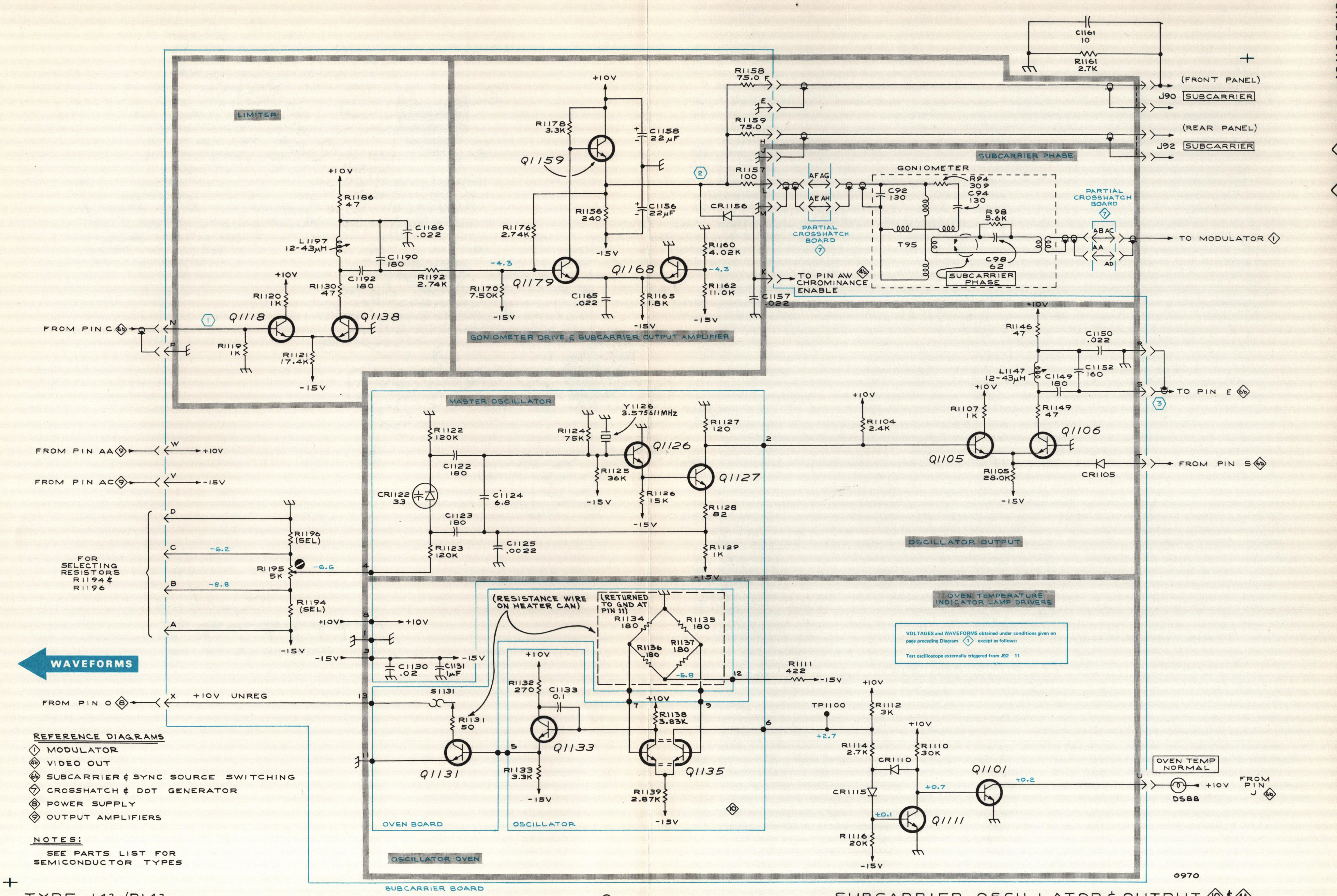
TYPE 142/R142 PAL TEST SIGNAL GENERATOR

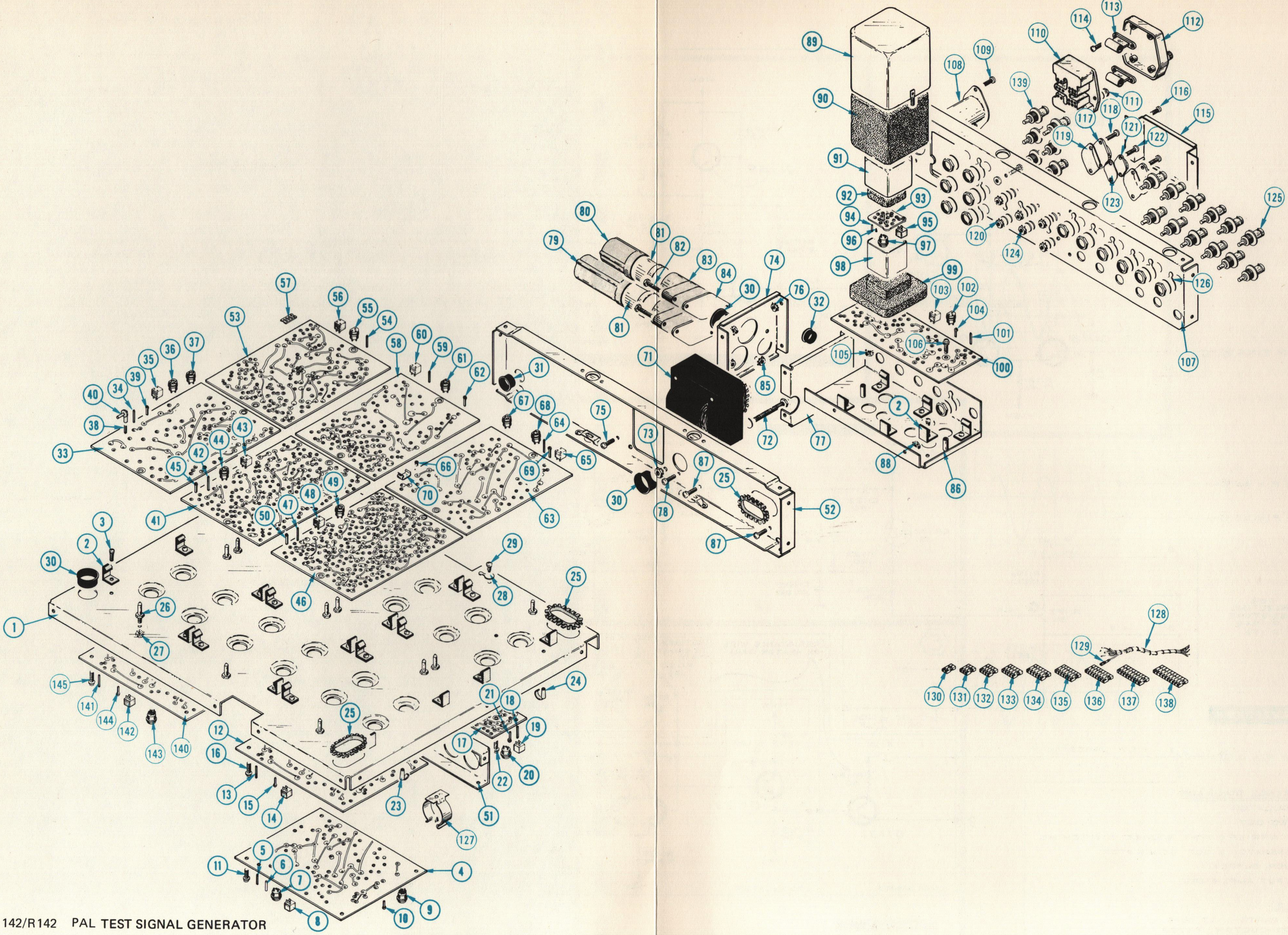
FIG. 1 FRONT & CABINET


1
100 mV/CM
0 V
0.1 μs/CM

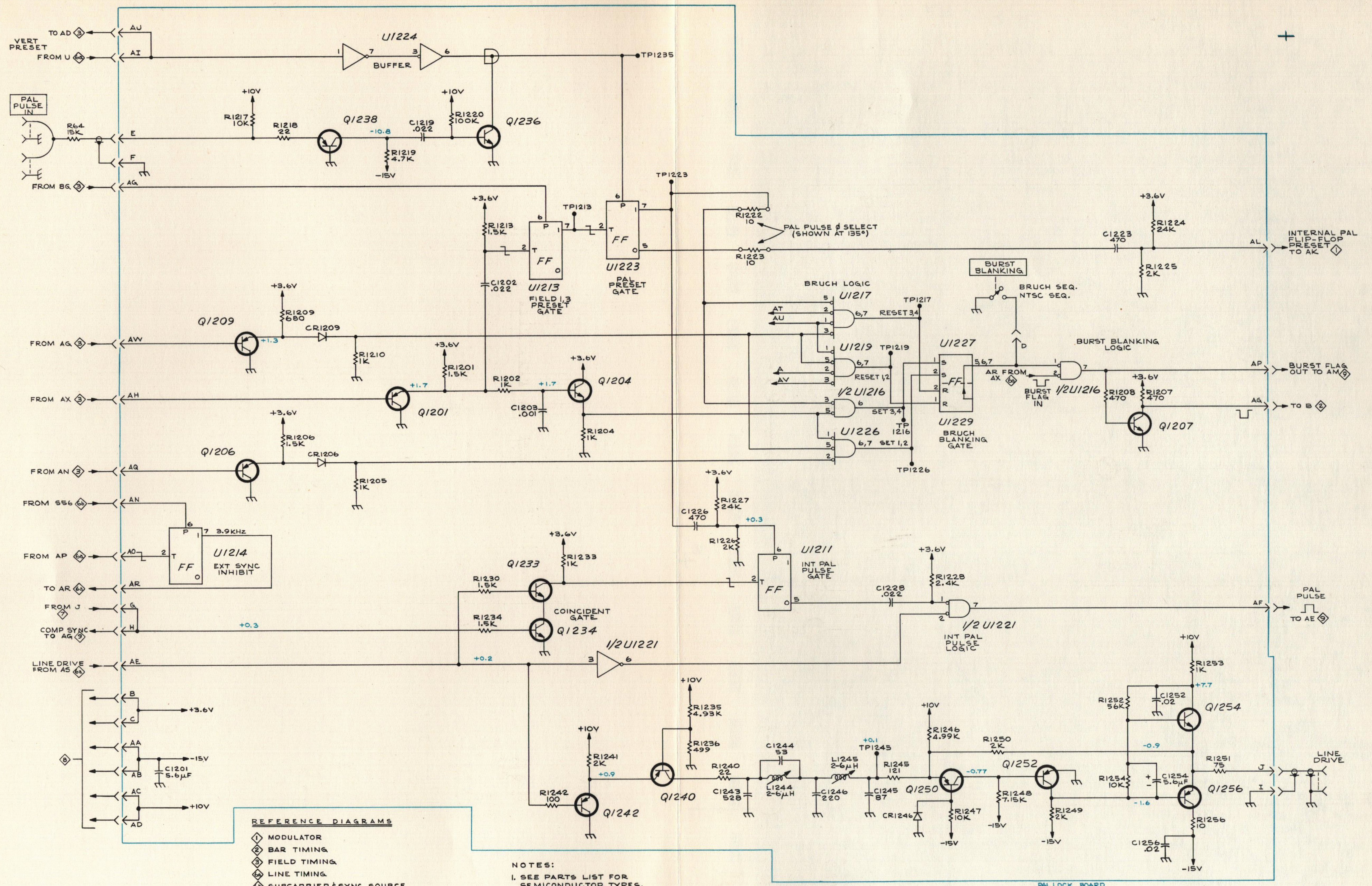

2
500 mV/CM
0 V
0.1 μs/CM


3
100 mV/CM
0 V
0.1 μs/CM


LIMITER
GONIOMETER DRIVE & SUBCARRIER OUTPUT AMPLIFIER
SUBCARRIER PHASE
GONIOMETER
PARTIAL CROSSHATCH BOARD
(FRONT PANEL) J90 SUBCARRIER
(REAR PANEL) J92 SUBCARRIER
TO MODULATOR
TO PIN AW CHROMINANCE ENABLE
FROM PIN C
MASTER OSCILLATOR
OSCILLATOR OUTPUT
TO PIN E
FROM PIN S
FROM PIN AA
FROM PIN AC
FOR SELECTING RESISTORS R1194 & R1196
OVEN TEMPERATURE INDICATOR LAMP DRIVERS
VOLTAGES and WAVEFORMS obtained under conditions given on page preceding Diagram 1 except as follows:
Test oscilloscope externally triggered from J92
(RESISTANCE WIRE ON HEATER CAN)
(RETURNED TO GND AT PIN 11)
WAVEFORMS
FROM PIN O +10V UNREG
OVEN TEMP NORMAL
FROM PIN J
OVEN BOARD
OSCILLATOR
OSCILLATOR OVEN
SUBCARRIER BOARD
REFERENCE DIAGRAMS
1 MODULATOR
4 VIDEO OUT
6 SUBCARRIER & SYNC SOURCE SWITCHING
7 CROSSHATCH & DOT GENERATOR
8 POWER SUPPLY
9 OUTPUT AMPLIFIERS
NOTES:
SEE PARTS LIST FOR SEMICONDUCTOR TYPES
0970



TYPE 142/R142 PAL TEST SIGNAL GENERATOR



REFERENCE DIAGRAMS

1. MODULATOR
2. BAR TIMING
3. FIELD TIMING
4. LINE TIMING
5. SUBCARRIER & SYNC SOURCE SWITCHING
7. CROSSHATCH & DOT GENERATOR
8. POWER SUPPLY
9. OUTPUT AMPLIFIERS

NOTES:
1. SEE PARTS LIST FOR SEMICONDUCTOR TYPES.
2. ALL I.C.'S; CONNECT PIN 8 TO +3.6V & PIN 4 TO GROUND.
3. ALL UNUSED I.C. PINS ARE GROUNDED.

RMG 0970

FIG. 3 STANDARD ACCESSORIES

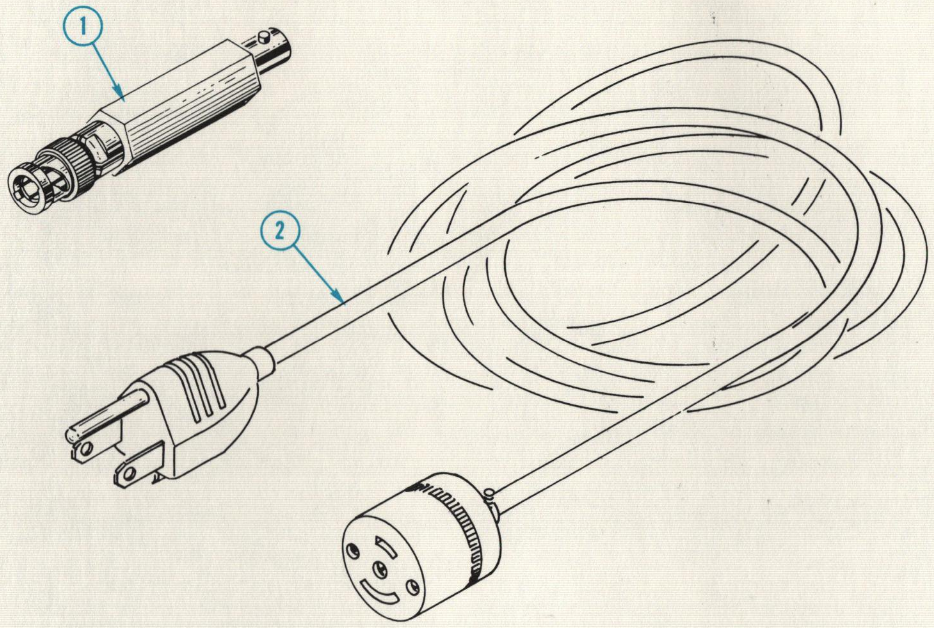
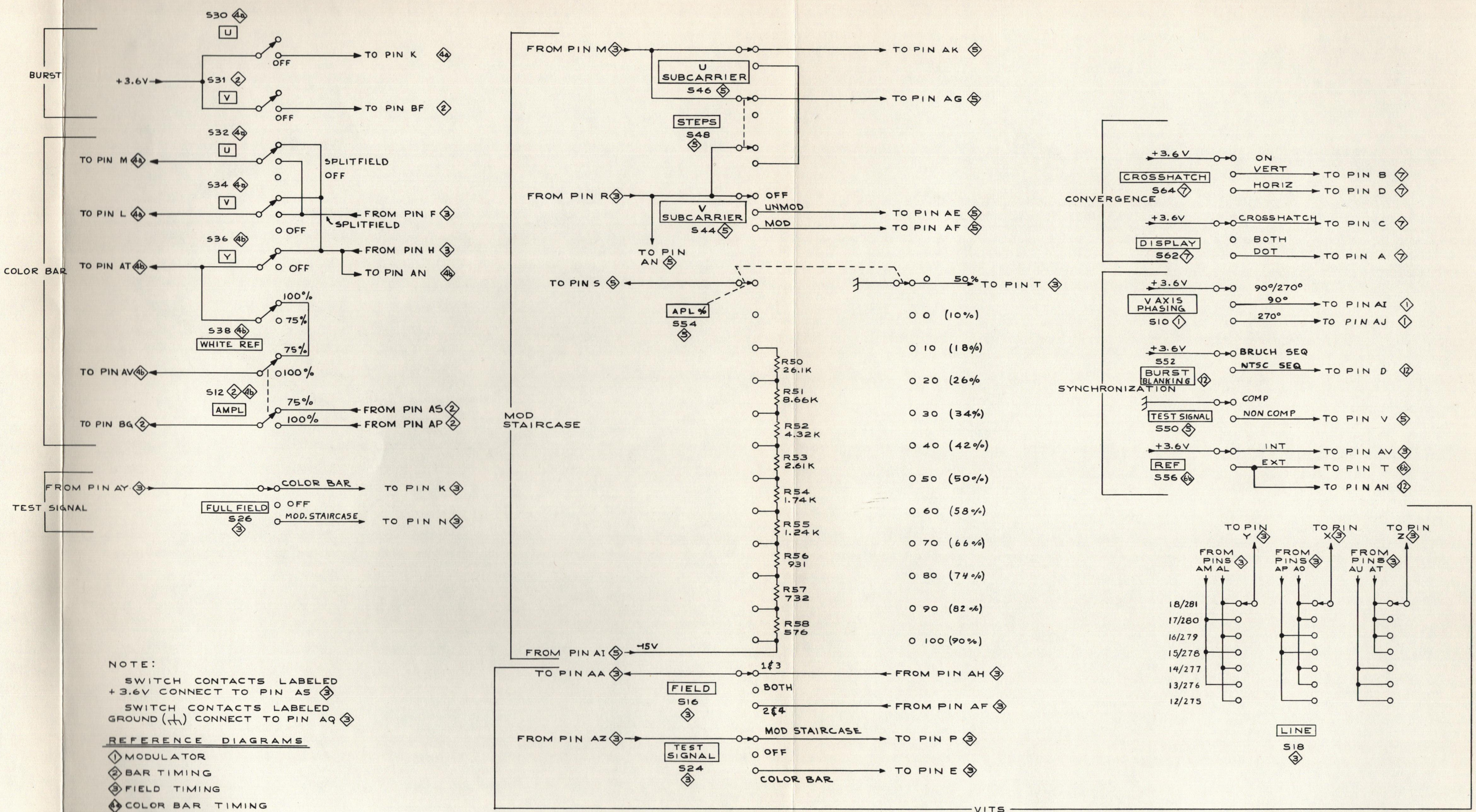


Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	1 2 3 4 5 Description
3-1	011-0103-02			1	TERMINATION, 75 Ω, BNC
-2	161-0036-00			1	CABLE ASSEMBLY, power, 3 wire, 7.50 feet long
	351-0195-00[5]			1	TRACK, slide, stationary & intersection (pair not shown)
	070-1031-00			2	MANUAL, instruction (not shown)

[5]Type R142 only.



NOTE:

SWITCH CONTACTS LABELED +3.6V CONNECT TO PIN AS 3

SWITCH CONTACTS LABELED GROUND (⏚) CONNECT TO PIN AQ 3

REFERENCE DIAGRAMS

1 MODULATOR
2 BAR TIMING
3 FIELD TIMING
4a COLOR BAR TIMING
4b VIDEO OUTPUT
5 STAIRCASE
6b LINE TIMING
7 CROSSHATCH & DOT GENERATOR
12 PAL LOCK

TYPE 142 / R142

A

0970

SWITCHING DIAGRAM

FIG. 4 REPACKAGING

CARTON ASSEMBLY
(Part No. 065-0120-00)

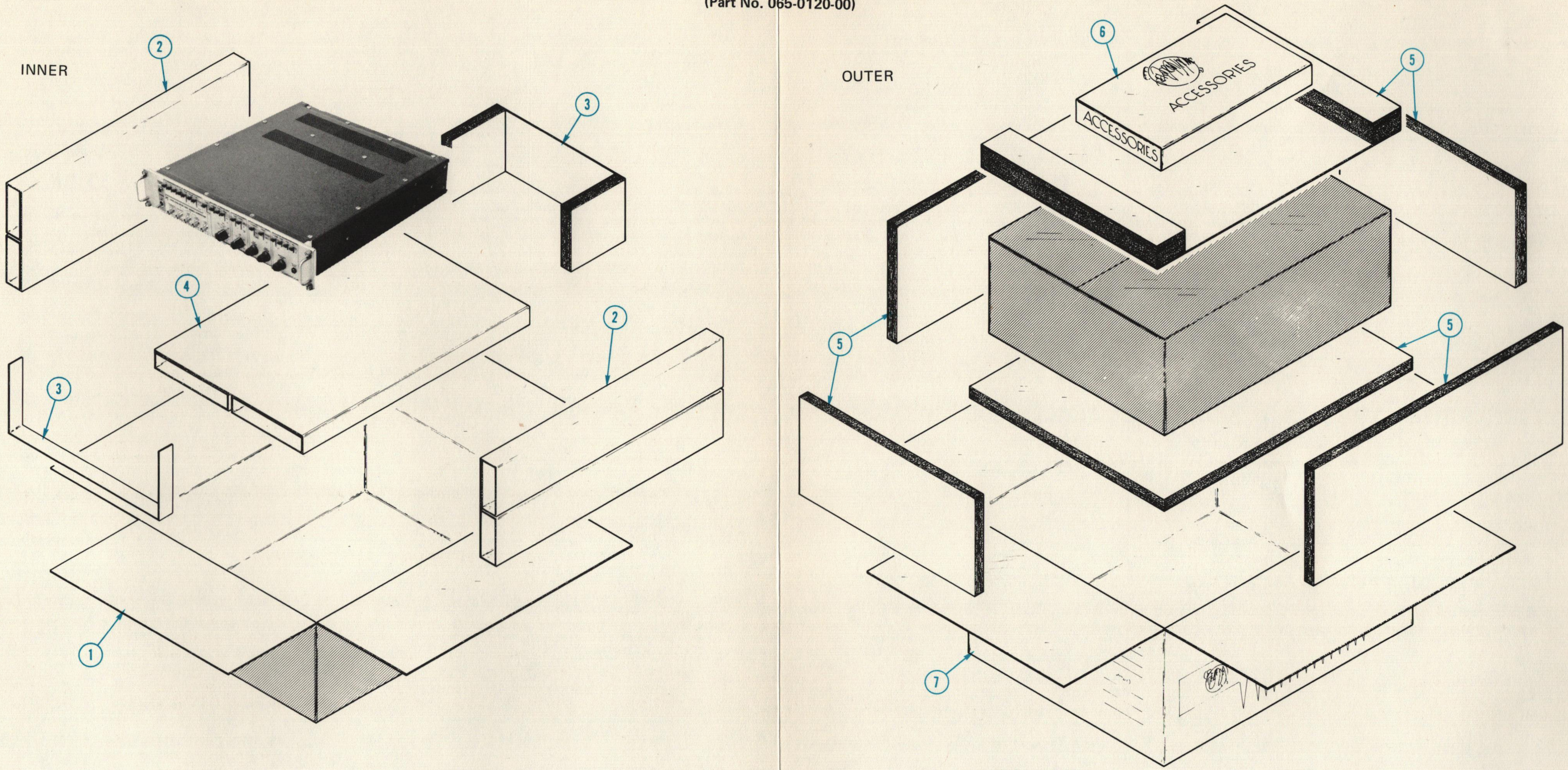


Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	1 2 3 4 5 Description
4-	065-0120-00			1	CARTON ASSEMBLY
	- - - - - -			-	carton assembly includes
-1	004-0460-00			1	CARTON, inner
-2	004-0360-00			1	PAD SET
-3	004-0359-00			1	PAD SET
-4	004-0357-00			3	PAD
-5	004-0361-00			1	PAD SET
-6	004-0462-00			1	CARTON, accessory
-7	004-0461-00			1	CARTON, outer

Ⓐ

FIGURE AND INDEX NUMBERS

Items in this section are referenced by figure and index numbers to the illustrations which appear either on the back of the diagrams or on pullout pages immediately following the diagrams of the instruction manual.

INDENTATION SYSTEM

This mechanical parts list is indented to indicated item relationships. Following is an example of the indentation system used in the Description column.

Assembly and/or Component
  Detail Part of Assembly and/or Component
  mounting hardware for Detail Part
    Parts of Detail Part
    mounting hardware for Parts of Detail Part
mounting hardware for Assembly and/or Component

Mounting hardware always appears in the same indentation as the item it mounts, while the detail parts are indented to the right. Indented items are part of, and included with, the next higher indentation.

Mounting hardware must be purchased separately, unless otherwise specified.

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial or model number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

ABBREVIATIONS AND SYMBOLS

For an explanation of the abbreviations and symbols used in this section, please refer to the page immediately preceding the Electrical Parts List in this instruction manual.

INDEX OF MECHANICAL AND REPACKAGING PARTS ILLUSTRATIONS

Title	Location (reverse side of)
Figure 1 Front & Cabinet	Output Amplifiers Diagram
Figure 2 Chassis & Rear	Subcarrier & Oscillator and Output Diagrams
Figure 3 Accessories	Pal Lock Diagram
Figure 4 Repackaging	Switching Diagram

SECTION 9
MECHANICAL PARTS LIST

FIGURE 1 FRONT & CABINET

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	Description 1 2 3 4 5
1-1	366-0215-02			1	KNOB, gray—U (BURST)
-2	260-0731-00			1	SWITCH, lever—U (BURST)
	- - - - - - -			-	mounting hardware: (not included w/switch)
-3	220-0413-00			2	NUT, switch mounting
-4	366-0215-02			1	KNOB, gray—V (BURST)
-5	260-0731-00			1	SWITCH, lever—V (BURST)
	- - - - - - -			-	mounting hardware: (not included w/switch)
	220-0413-00			2	NUT, switch mounting
-6	366-0215-02			1	KNOB, gray—U (COLOR BAR)
-7	260-0731-00			1	SWITCH, lever—U (COLOR BAR)
	- - - - - - -			-	mounting hardware: (not included w/switch)
	220-0413-00			2	NUT, switch mounting
-8	366-0215-02			1	KNOB, gray—V (COLOR BAR)
-9	260-0664-00			1	SWITCH, lever—V (COLOR BAR)
	- - - - - - -			-	mounting hardware: (not included w/switch)
	220-0413-00			2	NUT, switch mounting
-10	366-0215-02			1	KNOB, gray—Y
-11	260-0621-00			1	SWITCH, lever—Y
	- - - - - - -			-	mounting hardware: (not included w/switch)
	220-0413-00			2	NUT, switch mounting
-12	366-0215-02			1	KNOB, gray—WHITE REF
-13	260-0731-00			1	SWITCH, lever—WHITE REF
	- - - - - - -			-	mounting hardware: (not included w/switch)
	220-0413-00			2	NUT, switch mounting
-14	366-0215-02			1	KNOB, gray—AMPL
-15	260-0621-00			1	SWITCH, lever—AMPL
	- - - - - - -			-	mounting hardware: (not included w/switch)
	220-0413-00			2	NUT, switch mounting
-16	366-0215-02			1	KNOB, gray—FULL FIELD
-17	260-0621-00			1	SWITCH, lever—FULL FIELD
	- - - - - - -			-	mounting hardware: (not included w/switch)
	220-0413-00			2	NUT, switch mounting

FIGURE 1 FRONT & CABINET (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	1 2 3 4 5 Description
1-18	366-0215-02			1	KNOB, gray—U SUBCARRIER
-19	260-0731-00			1	SWITCH, lever—U SUBCARRIER
	- - - - - -			-	mounting hardware: (not included w/switch)
	220-0413-00			2	NUT, switch mounting
-20	366-0215-02			1	KNOB, gray—STEPS
-21	260-0664-00			1	SWITCH, lever—STEPS
	- - - - - -			-	mounting hardware: (not included w/switch)
	220-0413-00			2	NUT, switch mounting
-22	366-0215-02			1	KNOB, gray—V SUBCARRIER
-23	260-0621-00			1	SWITCH, lever—V SUBCARRIER
	- - - - - -			-	mounting hardware: (not included w/switch)
	220-0413-00			2	NUT, switch mounting
-24	366-0215-02			1	KNOB, gray—FIELD
-25	260-0621-00			1	SWITCH, lever—FIELD
	- - - - - -			-	mounting hardware: (not included w/switch)
	220-0413-00			2	NUT, switch mounting
-26	366-0215-02			1	KNOB, gray—TEST SIGNAL
-27	260-0621-00			1	SWITCH, lever—TEST SIGNAL
	- - - - - -			-	mounting hardware: (not included w/switch)
	220-0413-00			2	NUT, switch mounting
-28	366-0215-02			1	KNOB, gray—CROSSHATCH
-29	260-0621-00			1	SWITCH, lever—CROSSHATCH
	- - - - - -			-	mounting hardware: (not included w/switch)
	220-0413-00			2	NUT, switch mounting
-30	366-0215-02			1	KNOB, gray—DISPLAY
-31	260-0621-00			1	SWITCH, lever—DISPLAY
	- - - - - -			-	mounting hardware: (not included w/switch)
	220-0413-00			2	NUT, switch mounting
-32	366-0215-02			1	KNOB, gray—V AXIS PHASING
-33	260-0621-00			1	SWITCH, lever—V AXIS PHASING
	- - - - - -			-	mounting hardware: (not included w/switch)
	220-0413-00			2	NUT, switch mounting
-34	366-0215-02			1	KNOB, gray—BURST BLANKING
-35	260-0731-00			1	SWITCH, lever—BURST BLANKING
	- - - - - -			-	mounting hardware: (not included w/switch)
	220-0413-00			2	NUT, switch mounting
-36	366-0215-02			1	KNOB, gray—TEST SIGNAL
-37	260-0731-00			1	SWITCH, lever—TEST SIGNAL
	- - - - - -			-	mounting hardware: (not included w/switch)
	220-0413-00			2	NUT, switch mounting

FIGURE 1 FRONT & CABINET (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	1 2 3 4 5 Description
1-38	366-0215-02			1	KNOB, gray—REF
-39	260-0731-00			1	SWITCH, lever—REF
	- - - - - -			-	mounting hardware: (not included w/switch)
	220-0413-00			2	NUT, switch mounting
-40	366-0500-00			1	KNOB, gray—APL %
	- - - - - -			-	knob includes:
	213-0153-00			2	SETSCREW, 5-40 x 0.125 inch, HSS
-41	260-1088-00			1	SWITCH, rotary—APL %, unwired
	- - - - - -			-	mounting hardware: (not included w/switch)
	210-0978-00			1	WASHER, flat, 0.375 ID x 0.50 inch OD
-42	210-0590-00			1	NUT, hex., 0.375-32 x 0.438 inch
-43	366-0500-00			1	KNOB, gray—LINES
	- - - - - -			-	knob includes:
	213-0153-00			2	SETSCREW, 5-40 x 0.125 inch, HSS
-44	260-1087-00			1	SWITCH, rotary—LINES, unwired
	- - - - - -			-	mounting hardware: (not included w/switch)
	210-0978-00			1	WASHER, flat, 0.375 ID x 0.50 inch OD
-45	210-0590-00			1	NUT, hex., 0.375-32 x 0.438 inch
-46	366-1026-00			1	KNOB, gray—VERT POSITION
	- - - - - -			-	knob includes:
	213-0153-00			2	SETSCREW, 5-40 x 0.125 inch, HSS
-47	- - - - - -			1	RESISTOR, variable
	- - - - - -			-	mounting hardware: (not included w/resistor)
	210-0978-00			1	WASHER, flat, 0.375 ID x 0.50 inch OD
-48	210-0590-00			1	NUT, hex., 0.375-32 x 0.438 inch
-49	366-1026-00			1	KNOB, gray—HORIZ POSITION
	- - - - - -			-	knob includes:
	213-0153-00			2	SETSCREW, 5-40 x 0.125 inch, HSS
-50	- - - - - -			1	RESISTOR, variable
	- - - - - -			-	mounting hardware: (not included w/resistor)
	210-0978-00			1	WASHER, flat, 0.375 ID x 0.50 inch OD
-51	210-0590-00			1	NUT, hex., 0.375-32 x 0.438 inch
-52	366-0498-00			1	KNOB, gray—SUBCARRIER PHASE
	- - - - - -			-	knob includes:
	213-0153-00			2	SETSCREW, 5-40 x 0.125 inch, HSS
-53	- - - - - -			1	GONIOMETER
	- - - - - -			-	goniometer includes:
-54	210-0048-00			1	WASHER, lock, internal, 0.312 ID x 0.425 inch OD
-55	210-1025-00			1	WASHER, flat, 0.312 ID x 0.474 inch OD
	220-0576-00			1	NUT, hex., 0.375-32 x 0.437 inch
	210-0894-00			1	WASHER, plastic, 0.190 ID x 0.438 inch OD
-56	210-1106-00			1	WASHER, spring tension, 0.205 ID x 0.50 inch OD

FIGURE 1 FRONT & CABINET (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	Description 1 2 3 4 5
1-57	260-0276-00			1	SWITCH, toggle—POWER
	- - - - - -			-	mounting hardware: (not included w/switch)
-58	210-0414-00			1	NUT, hex., 0.469-32 x 0.638 inch
-59	337-1155-00			1	SHIELD, switch
-60	354-0055-00			1	RING, locking
	210-0902-00			1	WASHER, flat, 0.47 ID x 0.656 inch OD
-61	210-0473-00			1	NUT, l2 sided, 0.469-32 x 0.634 inch
-62	333-1311-00[1]			1	PANEL, front
-63	333-1310-00[2]			1	PANEL, front
-64	367-0102-00[1]			2	HANDLE, carrying
	- - - - - -			-	mounting hardware for each: (not included w/handle)
-65	212-0004-00[1]			2	SCREW, 8-32 x 0.312 inch, PHS
-66	213-0216-00[1]			4	THUMBSCREW, 10-32 x 0.750 inch
-67	210-0894-00[1]			4	WASHER, plastic
-68	354-0025-00[1]			4	RING, retaining
-69	407-0510-00[1]			2	BRACKET, angle
	- - - - - -			-	mounting hardware for each: (not included w/bracket)
-70	212-0004-00[1]			2	SCREW, 8-32 x 0.312 inch, PHS
-71	124-0216-00[2]			2	STRIP, trim, plastic
	- - - - - -			-	mounting hardware for each: (not included w/strip)
	212-0068-00[2]			2	SCREW, 8-32 x 0.312 inch, THS
-72	136-0164-00			1	SOCKET, light
	- - - - - -			-	mounting hardware: (not included w/socket)
-73	210-0413-00			1	NUT, hex., 0.375-32 x 0.50 inch
	210-0012-00			1	WASHER, lock, internal, 0.375 ID x 0.50 inch OD
	210-0978-00			1	WASHER, flat, 0.375 ID x 0.50 inch OD
-74	220-0480-02			1	NUT, plain, 0.377-32 x 0.438 inch
-75	136-0079-00			1	SOCKET ASSEMBLY, w/green jewel & hardware
-76	131-0126-00			5	CONNECTOR, coaxial, 1 contact, BNC, female, w/hardware
	- - - - - -			-	mounting hardware for each: (not included w/connector)
-77	210-0241-00			1	LUG, terminal
-78	386-1605-00			1	SUBPANEL, front
-79	348-0048-00[2]			4	FOOT, rubber
-80	390-0065-00			1	CABINET SIDE, right
	- - - - - -			-	mounting hardware: (not included w/cabinet side)
-81	211-0538-00			10	SCREW, 6-32 x 0.312 inch, 100° csk, FHS
	210-0457-00			10	NUT, keps, 6-32 x 0.312 inch
-82	390-0066-00			1	CABINET SIDE, left
	- - - - - -			-	mounting hardware: (not included w/cabinet side)
-83	211-0538-00			10	SCREW, 6-32 x 0.312 inch, 100° csk, FHS
	210-0457-00			10	NUT, keps, 6-32 x 0.312 inch

[1]Type R142 only.

[2]Type 142 only.

FIGURE 1 FRONT & CABINET (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	1 2 3 4 5 Description
1-84	351-0104-00[3]			1	SLIDE, section (pair)
	- - - - - -			-	mounting hardware for each: (not included w/slide)
-85	212-0004-00[3]			2	SCREW, 8-32 x 0.312 inch, PHS
-86	390-0112-00			1	CABINET TOP
	- - - - - -			-	cabinet top includes:
-87	355-0134-00			2	STUD, turnlock fastener, FHS
-88	355-0135-00			12	STUD, turnlock fastener, OHS
-89	214-0389-00			14	FASTENER, retainer
-90	390-0063-00			1	CABINET BOTTOM
	- - - - - -			-	cabinet bottom includes:
-91	355-0134-00			2	STUD, turnlock fastener, FHS
-92	355-0135-00			12	STUD, turnlock fastener, OHS
-93	214-0389-00			14	FASTENER, retainer
-94	386-1663-00[4]			1	PLATE, handle mounting
	- - - - - -			-	plate includes:
-95	344-0098-00			2	CLIP
-96	367-0037-00			1	HANDLE
	- - - - - -			-	mounting hardware: (not included w/handle)
-97	212-0506-00			2	SCREW, 10-32 x 0.375 inch, 100° csk, FHS
	- - - - - -			-	mounting hardware: (not included w/plate)
	212-0507-00[4]			2	SCREW, 10-32 x 0.375 inch, PHS

[3]Type R142 only.

[4]Type 142 only.

FIGURE 2 CHASSIS & REAR

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	Description 1 2 3 4 5
2-1	441-0824-01			1	CHASSIS, main
-2	344-0133-00			30	CLIP, circuit board
	- - - - - -			-	mounting hardware for each: (not included w/clip)
-3	213-0138-00			1	SCREW, sheet metal, #4 x 0.188 inch, PHS
-4	670-0307-01			1	CIRCUIT BOARD ASSEMBLY—CROSSHATCH
	- - - - - -			-	circuit board assembly includes:
	388-1324-00			1	CIRCUIT BOARD
-5	131-0589-00			26	TERMINAL, pin, 0.50 inch long
-6	131-0633-00			4	TERMINAL, pin, 0.385 inch long
-7	136-0183-00			1	SOCKET, transistor, 3 pin
-8	136-0220-00			25	SOCKET, transistor, 3 pin, square
-9	136-0237-00			19	SOCKET, semiconductor, 8 pin
-10	214-0579-00			16	PIN, test point
	- - - - - -			-	mounting hardware: (not included w/circuit board assembly)
-11	211-0116-00			4	SCREW, sems, 4-40 x 0.312 inch, PHB
-12	670-0308-00			1	CIRCUIT BOARD ASSEMBLY—OUTPUT AMPS
	- - - - - -			-	circuit board assembly includes:
	388-1325-00			1	CIRCUIT BOARD
-13	131-0589-00			23	TERMINAL, pin, 0.50 inch long
-14	136-0220-00			33	SOCKET, transistor, 3 pin, square
-15	214-0579-00			7	PIN, test point
	- - - - - -			-	mounting hardware: (not included w/circuit board assembly)
-16	211-0116-00			4	SCREW, sems, 4-40 x 0.312 inch, PHB
-17	670-0324-00			1	CIRCUIT BOARD ASSEMBLY—POWER SUPPLY
	- - - - - -			-	circuit board assembly includes:
	388-1467-00			1	CIRCUIT BOARD
-18	131-0589-00			39	TERMINAL, pin, 0.50 inch long
-19	136-0183-00			3	SOCKET, transistor, 3 pin
-20	136-0220-00			10	SOCKET, transistor, 3 pin, square
-21	214-0579-00			4	PIN, test point
	- - - - - -			-	mounting hardware: (not included w/circuit board assembly)
-22	211-0116-00			3	SCREW, sems, 4-40 x 0.188 inch, PHB
-23	343-0088-00			2	CLAMP, cable, plastic, small
-24	343-0089-00			1	CLAMP, cable, plastic, large
-25	255-0334-00			ft	CHANNEL, plastic, 3 lengths of 3.75 inches each
-26	214-1169-00			12	PIN, guide
	- - - - - -			-	mounting hardware for each: (not included w/pin)
-27	210-0457-00			1	NUT, keps, 6-32 x 0.312 inch
-28	210-0201-00			4	LUG, solder, SE #4
	- - - - - -			-	mounting hardware for each: (not included w/lug)
-29	213-0044-00			1	SCREW, thread forming, 5-32 x 0.188 inch, PHS

FIGURE 2 CHASSIS & REAR (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	1 2 3 4 5 Description
2-30	348-0050-00			2	GROMMET, plastic, 0.75 inch diameter
-31	348-0063-00			4	GROMMET, plastic, 0.50 inch diameter
-32	348-0064-00			1	GROMMET, plastic, 0.625 inch diameter
-33	670-0301-00			1	CIRCUIT BOARD ASSEMBLY—MODULATOR
	- - - - - -			-	circuit board assembly includes:
	388-1318-00			1	CIRCUIT BOARD
-34	131-0589-00			29	TERMINAL, pin, 0.50 inch long
-35	136-0220-00			22	SOCKET, transistor, 3 pin, square
-36	136-0235-00			2	SOCKET, semiconductor, 6 pin
-37	136-0237-00			1	SOCKET, semiconductor, 8 pin
-38	214-0506-00			4	PIN, connector
-39	214-0579-00			10	PIN, test point
-40	352-0134-00			4	HOLDER, toroid
-41	670-0302-01			1	CIRCUIT BOARD ASSEMBLY—BAR TIMING
	- - - - - -			-	circuit board assembly includes:
	388-1319-00			1	CIRCUIT BOARD
-42	131-0589-00			49	TERMINAL, pin, 0.50 inch long
-43	136-0220-00			12	SOCKET, transistor, 3 pin, square
-44	136-0237-00			15	SOCKET, semiconductor, 8 pin
-45	214-0579-00			6	PIN, test point
-46	670-0303-01			1	CIRCUIT BOARD ASSEMBLY—FIELD TIMING
	- - - - - -			-	circuit board assembly includes:
	388-1320-00			1	CIRCUIT BOARD
-47	131-0589-00			54	TERMINAL pin, 0.50 inch long
-48	136-0220-00			15	SOCKET, transistor, 3 pin, square
-49	136-0237-00			35	SOCKET, semiconductor, 8 pin
-50	214-0579-00			11	PIN, test point
-51	386-1532-00			1	SUPPORT, chassis
-52	386-1487-00			1	SUPPORT, bracket
-53	670-0304-01			1	CIRCUIT BOARD ASSEMBLY—BAR DRIVE/VIDEO OUT
	- - - - - -			-	circuit board assembly includes:
	388-1321-00			1	CIRCUIT BOARD
-54	131-0589-00			43	TERMINAL, pin, 0.50 inch long
-55	136-0183-00			2	SOCKET, transistor, 3 pin
-56	136-0220-00			41	SOCKET, transistor, 3 pin, square
-57	136-0337-00			1	SOCKET, relay, 8 pin
-58	670-0305-00			1	CIRCUIT BOARD ASSEMBLY—STAIRCASE
	- - - - - -			-	circuit board assembly includes:
	388-1322-00			1	CIRCUIT BOARD
-59	131-0589-00			20	TERMINAL, pin 050 inch long.
-60	136-0220-00			25	SOCKET, transistor 3 pin square
-61	136-0237-00			11	SOCKET, semiconductor 8 pin
-62	214-0579-00			6	PIN, test point

FIGURE 2 CHASSIS & REAR (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	1 2 3 4 5 Description
2-63	670-0306-00			1	CIRCUIT BOARD ASSEMBLY—LINE TIMING
	- - - - - -			-	circuit board assembly includes:
	388-1323-00			1	CIRCUIT BOARD
-64	131-0589-00			35	TERMINAL, pin, 0.50 inch long
-65	136-0220-00			34	SOCKET, transistor, 3 pin, square
-66	136-0234-00			1	RECEPTACLE, electrical
-67	136-0235-00			1	SOCKET, semiconductor, 6 pin
-68	136-0237-00			23	SOCKET, semiconductor, 8 pin
-69	214-0579-00			23	PIN, test point
-70	352-0096-00			1	HOLDER, crystal
-71	- - - - - -			1	TRANSFORMER
	- - - - - -			-	mounting hardware: (not included w/transformer)
-72	212-0516-00			4	SCREW, 10-32 x 2 inches, HHS
	210-0812-00			4	WASHER, fiber, #10
	166-0227-00			4	TUBE, insulating, plastic (not shown)
-73	220-0410-00			4	NUT, keps, 10-32 x 0.375 inch
-74	407-0556-00			1	BRACKET, capacitor
	- - - - - -			-	mounting hardware: (not included w/bracket)
-75	211-0507-00			4	SCREW, 6-32 x 0.312 inch, PHS
-76	210-0457-00			4	NUT, keps, 6-32 x 0.312 inch
-77	407-0555-00			1	BRACKET, transformer
	- - - - - -			-	mounting hardware: (not included w/bracket)
	210-0457-00			4	NUT, keps, 6-32 x 0.312 inch
-78	211-0507-00			4	SCREW, 6-32 x 0.312 inch, PHS
-79	200-0293-00			1	COVER, capacitor, plastic, 1.365 ID x 2.563 inches long
-80	200-0538-00			1	COVER, capacitor plastic ,1365. ID x 1644 inches long
-81	- - - - - -			2	CAPACITOR
	- - - - - -			-	mounting hardware for each (not included w/capacitor)
-82	211-0588-00			2	SCREW, 6-32 x 0.75 inch HHS
-83	432-0048-00			1	BASE, capacitor mounting
-84	386-0254-00			1	PLATE, fiber, large
-85	210-0457-00			2	NUT, keps, 6-32 x 0.312 inch
-86	441-0892-00			1	CHASSIS
	- - - - - -			-	mounting hardware: (not included w/chassis)
-87	211-0504-00			2	SCREW, 6-32 x 0.25 inch, PHS
-88	210-0457-00			2	NUT, keps, 6-32 x 0.312 inch

FIGURE 2 CHASSIS & REAR (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	1 2 3 4 5 Description
2-	119-0210-01			1	OVEN ASSEMBLY
	- - - - - -			-	oven assembly includes:
-89	200-0906-01			1	COVER, oven assembly
-90	214-1097-01			1	INSULATOR, oven, thermal
-91	200-0769-00			1	COVER, oven inner
-92	348-0126-00			1	PAD, cushioning
-93	670-0310-01			1	CIRCUIT BOARD ASSEMBLY—S. C. OSC
	- - - - - -			-	circuit board assembly includes:
	388-1327-00			1	CIRCUIT BOARD
-94	131-0633-00			3	TERMINAL, pin, 0.385 inch long
-95	136-0220-00			3	SOCKET, transistor, 3 pin, square
-96	136-0234-00			2	RECEPTACLE, electrical
-97	136-0235-00			1	SOCKET, semiconductor, 6 pin
-98	205-0108-01			1	SHELL, oven
-99	214-1096-00			1	INSULATOR, oven, thermal
-100	670-0309-00			1	CIRCUIT BOARD ASSEMBLY—SUBCARRIER OUTPUT
	- - - - - -			-	circuit board assembly includes:
	388-1326-00			1	CIRCUIT BOARD
-101	131-0589-00			20	TERMINAL, pin, 0.50 inch long
-102	136-0183-00			1	SOCKET, transistor, 3 pin
-103	136-0220-00			8	SOCKET, transistor, 3 pin, square
-104	214-0579-00			1	PIN, test point
	210-1002-00			2	WASHER, flat, 0.125 ID x 0.25 inch OD
-105	210-0586-00			2	NUT, keps, 4-40 x 0.25 inch
	- - - - - -			-	mounting hardware: (not included w/oven assembly)
-106	211-0116-00			2	SCREW, sems, 4-40 x 0.312 inch, PHB
-107	386-1750-00			1	PANEL, rear
-108	- - - - - -			1	LINE FILTER
	- - - - - -			-	mounting hardware: (not included w/line filter)
	210-0457-00			2	NUT, keps, 6-32 x 0.312 inch
-109	211-0507-00			2	SCREW, 6-32 x 0.312 inch, PHS
-110	204-0279-00			1	BODY, line voltage selector
	- - - - - -			-	mounting hardware: (not included w/body)
	210-0006-00			2	WASHER, lock, internal, #6
-111	210-0407-00			2	NUT, hex., 6-32 x 0.25 inch
-112	200-0762-00			1	COVER, line voltage selector
	- - - - - -			-	cover includes:
-113	352-0102-00			2	HOLDER, fuse, plastic
	- - - - - -			-	mounting hardware for each: (not included w/holder)
-114	213-0088-00			2	SCREW, thread forming, #4 x 0.25 inch, PHS
-115	200-0918-01			1	COVER, transistor
	- - - - - -			-	mounting hardware: (not included w/cover)
-116	211-0008-00			4	SCREW, 4-40 x 0.25 inch, PHS

FIGURE 2 CHASSIS & REAR (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	1 2 3 4 5 Description
2-117	- - - - - -			2	TRANSISTOR
	- - - - - -			-	mounting hardware for each: (not included w/transistor)
-118	211-0510-00			2	SCREW, 6-32 x 0.375 inch, PHS
-119	386-0978-00			1	PLATE, insulator
	210-0975-00			2	WASHER, plastic, shouldered, 0.14 ID x 0.375 inch OD
	210-0803-00			2	WASHER, flat, 0.15 ID x 0.375 inch OD
	210-0202-00			1	LUG, solder, SE #6
-120	210-0457-00			2	NUT, keps, 6-32 x 0.312 inch
-121	- - - - - -			1	TRANSISTOR
	- - - - - -			-	mounting hardware: (not included w/transistor)
-122	211-0510-00			2	SCREW, 6-32 x 0.375 inch, PHS
-123	386-0143-00			1	PLATE, insulator
	210-0935-00			2	WASHER, fiber, shouldered, 0.14 ID x 0.375 inch OD
	210-0803-00			2	WASHER, flat, 0.15 ID x 0.375 inch OD
	210-0202-00			1	LUG, solder, SE #6
-124	210-0457-00			2	NUT, keps, 6-32 x 0.312 inch
-125	131-0126-00			15	CONNECTOR, coaxial, 1 contact, BNC, female, w/hardware
	- - - - - -			-	mounting hardware for each: (not included w/connector)
-126	210-0241-00			1	LUG, terminal
-127	344-0118-00			2	CLIP, capacitor mounting
	- - - - - -			-	mounting hardware for each: (not included w/clip)
	211-0504-00			1	SCREW, 6-32 x 0.25 inch, PHS
-129	179-1498-00			1	WIRING HARNESS, chassis
	- - - - - -			-	wiring harness includes:
-129	131-0621-00			237	CONNECTOR, terminal
	131-0622-00			12	CONNECTOR, terminal
	131-0792-00			4	CONNECTOR, terminal
-130	352-0198-00			2	HOLDER, terminal connector, 2 wire
-131	352-0199-00			4	HOLDER, terminal connector, 3 wire
-132	352-0200-00			4	HOLDER, terminal connector, 4 wire
-133	352-0201-00			6	HOLDER, terminal connector, 5 wire
-134	352-0202-00			3	HOLDER, terminal connector, 6 wire
-135	352-0203-00			6	HOLDER, terminal connector, 7 wire
-136	352-0204-00			1	HOLDER, terminal connector, 8 wire
-137	352-0205-00			3	HOLDER, terminal connector, 9 wire
-138	352-0206-00			16	HOLDER, terminal connector, 10 wire
	179-1398-00			1	WIRING HARNESS, power
	- - - - - -			-	wiring harness includes:
	131-0621-00			21	CONNECTOR, terminal
	352-0203-00			1	HOLDER, terminal connector, 7 wire
	352-0205-00			9	HOLDER, terminal connector, 9 wire
	179-1399-00			1	WIRING HARNESS, line voltage selector
	179-1499-00			1	WIRING HARNESS, coaxial
	- - - - - -			-	wiring harness includes:
	131-0621-00			24	CONNECTOR, terminal
	131-0622-00			22	CONNECTOR, terminal
	352-0198-00			1	HOLDER, terminal connector, 2 wire
	352-0200-00			2	HOLDER, terminal connector, 4 wire
	352-0203-00			2	HOLDER, terminal connector, 7 wire
	352-0206-00			1	HOLDER, terminal connector, 10 wire

FIGURE 2 CHASSIS & REAR (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	Description 1 2 3 4 5
2-139	131-0126-00			3	CONNECTOR, coaxial, 1 contact, BNC, female, w/hardware
-140	670-0326-00			1	CIRCUIT BOARD ASSEMBLY—PAL LOCK
	- - - - - -			-	circuit board assembly includes:
	388-1562-00			1	CIRCUIT BOARD
-141	131-0589-00			32	TERMINAL, pin, 0.50 inch long
-142	136-0220-00			15	SOCKET, transistor, 3 pin, square
-143	136-0237-00			12	SOCKET, semiconductor, 8 pin
-144	214-0579-00			9	PIN, test point
	- - - - - -			-	mounting hardware: (not included w/circuit board assembly)
-145	211-0116-00			4	SCREW, sems, 4-40 x 0.312 inch, PHB

MANUAL CHANGE INFORMATION

At Tektronix, we continually strive to keep up with latest electronic developments by adding circuit and component improvements to our instruments as soon as they are developed and tested.

Sometimes, due to printing and shipping requirements, we can't get these changes immediately into printed manuals. Hence, your manual may contain new change information on following pages.

A single change may affect several sections. Sections of the manual are often printed at different times, so some of the information on the change pages may already be in your manual. Since the change information sheets are carried in the manual until ALL changes are permanently entered, some duplication may occur. If no such change pages appear in this section, your manual is correct as printed.

TEXT CORRECTION

Section 1 Specification

Page 1-2 Table 1-1 Subcarrier Component

CHANGE: UNMOD to read, "30 millivolts within 5..."

MODULATED SUBCARRIER to read, "30 millivolts within 5...", and "Incidental phase error between 300 and 600 millivolt..."

Page 1-3 Table 1-2

CHANGE: Luminance and Chrominance Accuracy to read, "Relative amplitudes of all subcarrier frequency components are within 1% or residual subcarrier plus 1 millivolt, whichever is greater of the red chrominance bar.

Page 1-4 Table 1-3

CHANGE: COMP SYNC Isolation (Passive) to read, "...i.e., 34 dB..."

CHANGE: SUBCARRIER Isolation (Active) to read, "...at least 34 dB..."

Page 1-5

CHANGE: PAL PULSE Isolation (Active) to read,"...at least 40 dB..."

CHANGE: BURST Breezeway to read, "At least 500 ns from..."

ADD: under BURST

Delay from Horizontal Sync 5.55 μs within 5%.

ELECTRICAL PARTS LIST CORRECTION

BAR DRIVE & VIDEO OUT Circuit Board Assembly

CHANGE:

C496	290-0309-00	100 µF	25 V	Fixed	
R473	321-0228-00	2.32 kΩ	1/8 W		1%
R481	321-0172-00	604 Ω	1/8 W		1%

SUBCARRIER OUTPUT Circuit Board Assembly

ADD:

C1161	281-0613-00	10 pF	Cer	200 V	
R1161	315-0272-00	2.7 kΩ	1/4 W		5%